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Land Use Planning in a Publicly Owned Watershed: A Socioeconomic Analysis of Public Involvement

by

(C)

Mike Daniel

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

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IN

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Abstract

This study investigates problems associated with the process of land use planning and related decision making on a publicly owned watershed in south-eastern British Columbia. Conflicts over land use arose out of a proposal put forward by the British Columbia Forest Service to open the Nelson Watershed for timber harvest. Primary watershed uses prior to the proposal were water and amenity (recreation and landscape) uses. Problem areas addressed in the context above were: (1) the theoretical and practical issues of making trade-offs between extra-market (amenity and water) and market (timber) goods produced on publicly owned land; (2) the institutional factors involved in the policy formulation, planning and decision making processes used to determine land use trade-off(s); and (3) the problems associated with public involvement mechanisms used to contribute to the trade-off determination.

The specific study objective was to develop a method that could be used in: (1) identifying the potential land use trade-offs for the watershed; (2) defining what the groups involved considered as an acceptable land use pattern; and (3) incorporating public involvement, all as means of moving toward an optimum pattern in land use.

The pecuniary opportunity cost of making withdrawals of land in the watershed from timber harvest, so as to conserve amenity and water resource uses, was then calculated. Four land use scenarios, which incorporated spatial and temporal constraints on development in the watershed, were analyzed. Each scenario involved the construction of an opportunity cost schedule showing the pecuniary value of different land use alternatives.

Personal interviews with key representatives from interest groups, public agencies and forest industry involved in the land use conflict were carried out. Each interview required the individuals to: (1) fill out two questionnaires, (2) undergo an education process, and (3) choose a preferred land use option from a particular opportunity cost schedule.

Results obtained from the interview procedure indicated that the average opportunity cost accepted by the three groups involved was quite different. The differences reflected social, economic, and political constraints on the individual group representatives interviewed.

A conflict reducing form of land use planning was proposed. Various constraints (economic, financial, ownership and community) were incorporated into land use pattern determination. Public involvement was a key part of the proposed planning approach. Using an opportunity cost approach in land use pattern selection, an improvement in social net benefits, or efficiency gain, is obtained. Recommendations are made for the use of the approach developed in the study in cases in which land use conflicts are likely.

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1. Introduction

1.1 Introduction to the Study

This study is concerned with the use of renewable resources on publicly owned land. An investigation of problems that stem from trade-offs between proposed timber use and extra-market[1] goods, namely, water, outdoor recreation and landscape[2] is undertaken. These goods are produced in the Nelson Watershed which is located in the Nelson Forest Region of south-eastern British Columbia. In order to integrate the various uses of land the economic concept of maximization of social net benefit[3] is used. Social net benefits are often difficult to measure. In order to make this measurement, a trade-off schedule is developed to identify the land use alternatives that are feasible. An opportunity cost model is then constructed and incorporated into an interview procedure that provides a means of depicting the social costs and social benefits of the proposed timber harvest of the Nelson Watershed.

1.2 Background to the Problem

In general theoretical terms there are two broad areas of concern in utilizing resources. They are economic efficiency[4] and equity.[5] These two issues would ideally be considered jointly when citizens, governments and industrial groups develop policies, plans and decisions concerned with the use of renewable and non-renewable resources. Thus, any conflict between efficiency and equity could be considered explicitly in these decisions. Decision making[6] by

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[1]Defined as goods that have characteristics of indivisibility in consumption and/or nonexclusivity in use that preclude the establishment of market prices for them.
[2]In the study outdoor recreation and landscape are jointly defined as amenity.
[3]Defined as the net gains in welfare which flow from an economic decision whether or not they accrue to the individual or institution taking the decision, i.e., the total improvement in welfare of society as a whole, including the decision maker.
[4]Defined as allocative efficiency as opposed to productive efficiency, where with the former, scarce resources are allocated among goods and services produced by the economy; these resources are allocated efficiently (Pareto-efficiency) when it is not possible to change the allocation of resources without making someone worse off.
[5]Defined as the distribution of benefits and costs stemming from a project in relation to social policy which defines a particular income distribution as an objective.
[6]In this study decision making may also refer to the processes of planning and

government agencies has two problems -valuation of non-price extra-market goods and the trade-off between efficiency and equity.

Public involvement[7] is one mechanism for dealing with these problems and has been playing an ever growing role in Canada in the policy formulation, planning and decision making frameworks of public agencies. The Nelson Watershed area has had public involvement through the sponsorship of the British Columbia Forest Service since 1978-79. Interest groups and a "planning team" have been sponsored by the B.C.F.S.[8] to deal with land use conflicts in the Nelson Watershed.

The study used opportunity cost as a valuation mechanism and a focus of discussion for the planning team. The team represented "interest"[9] groups and their valuations represented the impact of the Nelson Watershed land use proposal on different groups in society.

1.3 Resource Scarcity

Naturally occurring resources are generally classified as non-renewable or renewable. This study concentrates only on the renewable resources of primary importance in the Nelson Watershed. The resources are timber, water and amenity, the latter including both landscape and extensive[10] outdoor recreation.

Any given renewable resource base has a specific sustainable yield of products which can be increased by resource management inputs. Two important issues for forestry land in Canada in this regard are (1) the rates and levels of renewable resource use on forested land and (2) the rates and levels of forest land withdrawals resulting from urban, agricultural and industrial area expansion. Changes in sustainable yield depend on the extent to which

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[6](cont'd) policy formulation related to public institutions.
[7]In this study public involvement refers to the collective involvement of interest groups, the general public, firms and government agencies or some combination thereof.
[8]The abbreviation B.C.F.S. refers to the British Columbia Forest Service or British Columbia Ministry of Forests.
[9]Interest groups refers to citizen groups, firms and government agencies.
[10]Defined as areas where recreation activity includes landscape viewing, hiking, and dispersed camping, where no sites have been established for concentrated use of the area.

management inputs compensate for any stock reductions as the result of resource extraction and other land withdrawals.

The increasing rate of use of forest resources (particularly saw and peeler sized timber) has led to declines in timber stocks (that are economically accessible)[11] in some regions of British Columbia. This situation is documented in the British Columbia Ministry of Forests, "Forest and Range Resources Analysis Technical Report" (1980)[12] and Reed (1978).[13] Local effects include the search by forestry firms for productive forest land to supply timber to their mills. As unharvested land comes under such scrutiny, conflicts with other uses may arise. Public agencies that determine the allocation of land for new harvesting are then presented with a trade-off decision between uses to be made. Demands for renewable resources on forested land that are greater than the available stock leads to land use conflicts in resource allocation and distribution. Public agencies with mandates to manage publicly owned resources encounter difficulties in balancing the demands for non-priced resources with those of priced resources, i.e., timber. This trade-off is a problem because: (1) many renewable resources, an exception being timber, are extra-market goods and cannot be valued easily due to the lack of market prices; (2) the structure and mandate of public agencies has been oriented towards single resources or defined sets of resources; and (3) public involvement to aid in the determination of the appropriate trade-off between priced and non-priced goods has only recently been used to deal with these kinds of allocation problems.

1.4 Role of Resource Agencies

Determination of the most socially beneficial use of publicly owned resources is in the domain of public agencies and politicians. Increasingly scarce renewable resources necessitates a change in political and organizational orientation toward more efficient resource use if

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[11]Defined as the stock of timber that is available for harvest at existing forest products prices and production costs.

[12]British Columbia Ministry of Forests, *Forest and Range Resources Analysis Technical Report*, Information Services Branch (1980), 778.

[13]Reed, F.L.C., and Associates Ltd., *Forest Management in Canada: Volume I*, Fish Envir. Can. Can. For. Ser. For Manag. Inst., Inf. Rep. FMR-X-102 (1978), 24.

increased net social benefits over time are to be realized. Public agencies and politicians must also define an appropriate distribution of resource use benefits and the means of achieving it. The B.C.F.S. has a mandate to develop forest resources so as to benefit present and future generations to the greatest extent possible. The Ministry is also partly responsible for insuring that the most equitable distribution of the benefits is achieved under existing political, economic and social constraints.

An economic perspective on the goals of public agencies dictates that social net benefits be maximized, taking into account both efficiency and equity . The British Columbia Forest Service objectives given below take into account social net benefit in terms of social welfare, efficiency in terms of resource revenues and industry profitability, and equity in terms of the various users and social impacts. The objectives taken from the B.C. Forest Act (1978) are as follows:

> The purposes and functions of the ministry are, under the direction of the minister, to
> a. encourage maximum productivity of the forest and range resources in the Province;
> b. manage, protect and conserve the forest and range resources of the Crown, having regard to the immediate and long term economic and social benefits they may confer on the Province;
> c. plan the use of the forest and range resources of the Crown, so that the production of timber and forage, the harvesting of timber, the grazing of livestock and the realization of fisheries, wildlife, water, outdoor recreation and other natural resource values are coordinated and integrated, in consultation and cooperation with other ministries and agencies of the Crown and with the private sector;
> d. encourage a vigorous, efficient and world competitive timber processing industry in the Province; and
> e. assert the financial interest of the Crown in its forest and range resources in a systematic and equitable manner. [14]

The benefits derived from the use (consumptive and non-consumptive) of the forest resources in British Columbia are substantial. Part of the consumptive benefits take the form of stumpage and taxes paid by the forest industry to the provincial government. Individuals directly employed in the forest industry, and those workers indirectly employed in linked sectors also contribute tax revenues to the province. In addition, the spinoff benefits of forest sector employment (direct and indirect) and income in local communities can be vital in maintaining

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[14]Province of British Columbia, *Forest Act*, (1978) Section 4.

economic stability.[15] However, in many resource use situations the objectives of efficiency and equity may be in conflict. Generally, trade-offs between these two objectives must be made by the Ministry of Forests when further use of forest resources is proposed. Thus, changes in socioeconomic benefits and costs or net benefits of timber harvest in the Nelson Watershed must be weighed against offsetting changes in net social benefits from alternative patterns of resource use.

1.5 Public Agencies

Another problem, related to the efficiency and equity trade-off problem, is the difficulty public agencies have in defining objectives concerned with the management of public lands that are relevant to prevailing social preferences. The problem stems from external and internal conflicts and stimulae. Internally, these conflicts may consist of power struggles, inadequate management and/or leadership, structural deficiencies and budgetary problems. External conflicts might consist of jurisdictional problems between public agencies, pressure applied by special interest groups, public opinion or cabinet policy. The two conflict forms may reduce the ability of an organization in its attempts to develop socially desirable policies and plans that are solutions to land use conflicts such as the one existing in the Nelson Watershed.

1.6 Role of Public Involvement

Public involvement in the area of renewable resource use has increased substantially during the last two decades in Canada. Concurrent with this increase in involvement has been the attachment of greater importance to understanding the nature and role of public involvement to better deal with conflict. By its very nature public involvement is a subject that is difficult to describe in a precise theoretical manner. However, there are some general concepts that can assist in a better understanding of the role of public involvement in conflict resolution.

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[15]See Byron, R.N., "Community Stability and Forest Policy in British Columbia," *Can. J. For. Res.*, 8 (1978), 61-66 for a discussion of these factors.

Conflict generally arises because of differences between the goals of society normally represented by public agencies, and those goals of impacted groups. Projects developed by public agencies often creates conflict. The differences between the efficiency and equity aspects of a given project also give rise to conflict. To deal with conflict in its initial stages or with conflict that is ongoing, public involvement has a useful role to play.

The efficiency considerations of a project may be dealt with by involving the impacted groups or their representatives in a participation process to value and weigh the project's social benefits and costs. From the equity standpoint, the input of the impacted groups in terms of their preferences for a particular distribution of project benefits is desireable so that full consideration of these preferences may be provided for in the determination of the final distribution of project benefits.

Some degree of citizen involvement in the processes of decision making, planning and policy formulation may be crucial in the success of public agency efforts to reduce conflict. The degree of involvement in the processes above, varies from tokenism to full participation. In many respects the degree of participation is determined by the political nature and scope of the agency project and by the characteristics of the impacted groups. These factors can severely limit the effectiveness of public involvement to deal with conflict. In addition, public involvement in the North American context is still relatively undeveloped; this condition has led on occasion to the use of public input forms that are not fully fitted to the conflict at hand. Further investigation of the role of public participation in conflict decision making, such as that existing over land use in the Nelson Watershed, is needed to increase the social net benefit derived from projects that allocate publicly owned resources.

1.7 Interest Groups

In situations where particular individual goals cannot be attained groups of varying descriptions form to achieve them. These groups, i.e., the voters, capital owners, members of political parties, interest groups, etc., can be termed as 'stakeholders' in public organizations.

Interest groups or power blocks can gain power and influence the planning, decision making and policy formulation in public agencies. The degree of representation (i.e., the range of people or groups that have a stake in the outcome of a plan, policy or decision) is also very important, since in many situations (especially in public hearings) broad representation does not occur with great frequency.

Directly related to the last point is the use of an appropriate involvement approach in situations where conflict arises over the proposed use of publicly owned resources. The use of public involvement measures to reduce conflict over what should be the dominant pattern of resource use in a given area over time can be costly both financially for sponsoring public agencies and socioeconomicly for those individuals or groups most affected if the form of involvement used is unsuitable. Therefore, considerable thought and planning is necessary to define the structure and function of public involvement programs so as to make them cost effective and useful as part of the decision making process.

The interest groups involved in the conflict over land use are the Nelson City Council directly representing the city and indirectly the citizens of Nelson, the Nelson and Area Watershed Committee representing concerned individuals in the City of Nelson and in surrounding areas, and the Mountain Station Water Users which represents water users in the watershed at elevations above the City of Nelson.

1.8 Statement of the Problem

Like many other regions in British Columbia, the Nelson Forest Region experienced early (1800's) mining and forest sector development and fairly rapid population and industrial expansion. Over a period of time economically available[16] timber and mineral stocks were depleted. This situation occurred for two reasons: (1) the relatively low initial cost of extracting wood and minerals resulted in high use rates of the two resources, and (2) a considerable area of physically inaccessible land at the extensive margin which limited the scope

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[16]See footnote 11.

of exploitation.

These factors led to an increasing cost of extraction for wood and minerals and ultimately resulted in the loss of markets. An example of an existing forestry problem is the degree of regeneration of cut-over sites. In forestry, the dense stands of natural timber have not been replaced, with a consequent reduction in stock. Regeneration has not been sufficient, notes the Forest and Range Resources Analysis Technical Report (1980). The report shows that the Nelson Forest Region had the highest area of N.S.R. (not satisfactorily restocked) productive forest land on a proportional basis (approx. 4.5%) of the total productive forest land base[17] of the eight Forest Regions in British Columbia (see Table 2.4). Within a range of five to twenty years, given the 1977 commitment level of 4.3 million cubic meters over 100 years, falldown[18] is expected to occur in five of the seven Timber Supply Areas in the Nelson Forest Region.[19]

The location of processing mills and the pattern of timber harvest have also contributed to the problem of timber availability in the Nelson Forest Region. Timber harvesting has tended to be concentrated in accessible areas and in areas which have had few conflicting alternative uses. Rising delivered wood costs have resulted in more distant harvest areas becoming economically nonviable. This extensive economic margin of land use shrinks when the market for forest products declines as in the most recent economic recession. The overall result has been to reduce the economically accessible timber stock for mills in the region. Local areas in the Nelson Forest Region are now experiencing a falldown in the available merchantable timber supply. The Kootenay Lake T.S.A. (Timber Supply Area) is presently in this situation. The Nelson Watershed study area is located within the T.S.A. An additional constraint on the timber supply in the Kootenay Lake T.S.A. has been the protected nature of the west arm of Kootenay Lake (see Map 2.2). This forest land was not harvested because of the considerable

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[17]The calculation does not include non-commercial and brush sites because of the predominance of these sites in northern regions of British Columbia.
[18]Falldown refers to the anticipated or actual decline in the physical volume of wood available for harvest in a management unit over a particular period of time.
[19]See British Columbia Ministry of Forests Technical Report, p. 489-499.

financial cost of developing a harvesting and transportation infrastructure on the south shore of the lake and the land use conflicts it would create with local residents. Nevertheless, the need to supplement the timber supply in the Kootenay Lake T.S.A. has created a situation in which the B.C.F.S. has developed plans to open the south shore for timber harvest. Any roads into the south shore must first pass through the Nelson Watershed. Thus, the Nelson Watershed is the key to the economic development of the remainder of the south shore timber east of the City of Nelson. In the first quarter of 1979 a plan was proposed by the B.C.F.S. to open the Nelson Watershed for timber harvest. Particular user groups in the area have pointed out potential conflicts with other land uses.

The primary use of the Nelson Watershed has been for water. Most residents living close to the Nelson Watershed, including those in the City of Nelson, depend upon the annual winter snow fall on the watershed and the subsequent spring run-off, surface (creek) and goundwater (spring or well) flow, to supply a large proportion of their yearly domestic water requirements. However, in some years the winter snowfall is insufficient, resulting in a quantity of water below the level of domestic consumption in rural areas and occasionally in the City of Nelson. Therefore, any negative alteration of water quantity and/or quality, as a result of logging and road construction, may have a serious impact on the water supply for urban and rural residents in the area.

Another concern is the potential public health hazard presented by opening the Nelson Watershed for use by the general public (recreationists). Active year-round logging roads would present the possibility that individuals could contaminate the water supply of the city and surrounding residents.

Secondary uses of the Nelson Watershed include extensive outdoor recreation and landscape viewing. The Kootenay Lake T.S.A. area is aesthetically appealing which produces a considerable demand for all kinds of outdoor recreation. Outdoor recreation activity on the Nelson Watershed is extensive in nature because of the relative inaccessibility (i.e., essentially roadless) of the area. Examples of activities are hiking, cross-country skiing and landscape

viewing (close). These activities may be less compatible with areas that are being actively logged. Landscape viewing (vista) is also an important attribute of the Nelson Watershed. Individuals living on the north shore of Kootenay Lake north of the City of Nelson have a good view of the watershed. There is concern on the part of some of these individuals that development of the south shore will reduce the intangible benefits derived from having an undisturbed view. Most individuals would not derive a great deal of utility from viewing a highly disturbed landscape, i.e., sites or areas that have been recently harvested or have had roads constructed through them.

There is a large area of relatively inaccessible land in the Kootenay Lake T.S.A. that is physically difficult to enter. Because of the physiography (e.g., large lake, steep slopes, and narrow boundary) and small size of the Kootenay Lake T.S.A. the land use conflicts that ordinarily arise are intensified. This situation arises because a variety of land uses are thus constrained to a smaller area of land in the T.S.A.

The particular problem the Forest Service in the Kootenay Lake T.S.A. must address is whether or not the construction and use of a main haul logging road and timber harvest can exist above the City of Nelson's water intakes and above rural water users. A subsidiary problem is whether or not the access to this particular area could be limited to reduce health hazards caused by outdoor recreationists if the area were opened to harvesting on a sustained basis.

The agency planning problem in the Nelson Forest Region has been identifying which resource use alternatives in the Nelson Watershed can be developed to satisfy as far as possible all the individuals and groups that have a vested interest. The timber requirements of the forest industry have public agencies opening the Nelson Watershed for harvest. Simultaneous with this action, interest groups are applying pressure on the public agencies involved to stop or limit the harvest plan. Therefore, the problem analysed in this study is the valuation of the non-timber uses of the Nelson Watershed and the use of such a valuation on the public involvement process to move towards an optimum pattern in land use.

1.9 Problem Solving Model

Evaluation of the problems associated with the proposal by the B.C.F.S. to develop the timber resource of the Nelson Watershed requires the establishment of an analytical framework to calculate the social net benefit of the Nelson Watershed timber harvest proposal and of the extra-market goods, i.e., the water and amenity resources. A trade-off has to be made between extra-market goods and the timber resource based on the social costs arising from the loss of the extra-market benefits produced in the Nelson Watershed as as result of timber harvest and road construction. Because different groups perceive different values of extra-market goods, there are different trade-off preferences among the different groups. This study seeks to identify such trade-off preferences.

An interview procedure with the various groups representatives was carried out in order to determine their trade-off preferences. Four parts comprise the interview procedure:

1. introduction,
2. information gathering, i.e., two questionnaires to determine the biases and preferences of key individuals on land use in the Nelson Watershed,
3. education of the individuals involved on key aspects of the resources and the land use plan proposed for the Nelson Watershed, and
4. the choice by each individual of the land use alternative they would prefer in different hypothetical Nelson Watershed land use scenarios.

An opportunity cost framework was used for each of four scenarios to arrive at trade-off values. For each scenario an opportunity cost schedule is devised that incorporates a series of spatial land use alternatives for the watershed. Each land use alternative has a certain area of watershed land that is allocated to either timber harvest or to the extra-market goods described earlier. The assumption is made that there is a conflicting relationship between the use of extra-market goods and timber in the watershed. The changes in allocation towards more or less of a particular form of land use, can be termed the opportunity cost of making that change. By defining land use alternatives and then making trade-offs between the development

alternatives, the schedule establishes trade-off preferences for the extra-market goods in the watershed. Since wood products have readily definable market prices, the cost of reducing the volume available for harvesting over a specified period of time can be determined and termed the opportunity cost of such a change. This opportunity cost is associated with the change in land use from a timber harvest to an extra-market use. A cost of X dollars per hectare can be determined which can be considered the minimum value placed on the extra-market goods by particular groups.

In addition to the calculation of the loss in net present value resulting from the withdrawal of watershed land from timber harvest, a subsequent increase in unemployment in local forest sector and linked sectors is assumed to occur. The loss in direct and indirect income stemming from the withdrawal was also calculated and included separately in the opportunity cost schedule. By asking the interviewed individuals to choose a particular land use alternative for each scenario, an average accepted opportunity cost for each individual is determined. The individuals interviewed are asked to respond as representatives of their respective interest group, firm or public agency, thereby revealing the opportunity cost of a particular land use alternative for the Nelson Watershed acceptable to their group. A temporal aspect is added to the analysis by asking the representatives if their choice would change if the timber harvest proposal were not implemented for a certain number of years.

1.10 Overview of Subsequent Chapters

The following chapter provides a detailed description of the study area. Information is provided for the Nelson Forest Region, Kootenay Lake T.S.A., and Nelson Watershed. Important physical, social and economic characteristics of each area are presented. Chapter three describes the theoretical background material related to problems of land use planning and decision making. Specific problems of the economic valuation of non-priced goods, the role of public insititutions and of public involvement in land use decision making are investigated. The fourth chapter presents the derivation of the opportunity cost schedules used in the interview

process. Scenarios and land use alternatives are described along with the use of the opportunity cost schedule. In chapter five the interview procedure used to determine land use preferences in the Nelson Watershed is described. Each of the components, i.e., background questionnaires, education, and evaluation of trade-offs, of the interview procedure is described along with a section addressing conflict identification. Chapter six gives the results of the interview process. Information from the background questionnaires, trade-off preferences calculated and involvement gain indicators is provided. The final chapter provides a discussion of the results, derives some overall conclusions based on the study investigation, and makes some recommendations towards future areas of work in light of the analysis. Furthermore, recommendations for alternative public agency and public involvement forms to deal with land use conflicts are made.

2. Study Area Description

2.1 Introduction

The study area lies in the southeast corner of the Province of British Columbia (see Plate 2.1). The area was defined mainly for planning purposes and was named the Nelson Forest Region[20] by the British Columbia Ministry of Forests. The N.F.R. is divided into seven Timber Supply Areas (see Plate 2.2), the T.S.A. where research work was carried out is the Kootenay Lake T.S.A. Two P.S.Y.U.'s (Public Sustained Yield Unit), Creston and Lardeau, make up the southern and northern halves of the T.S.A. respectively. The local research area lies in the Lardeau P.S.Y.U. and is found in Supply Block E (see Plates 2.3 and 2.4). The objectives of this chapter are: (1) to briefly describe the physical, social and economic characteristics of the Nelson Forest Region and (2) to describe in more detail the characteristics mentioned in (1) above for the Kootenay Lake Timber Supply Area and the Nelson Watershed.

2.2 Regional Description

The Nelson Forest Region encompasses approximately 7.5 million hectares or close to one sixth of the total land mass of British Columbia. An area of 3.8 million hectares out of the total 7.5 million hectares are productive forest land and represents eight percent of British Columbia's total productive forest land base. Average north-south and east-west distances are 300 and 250 kilometers respectively. Note Tables 2.1 and 2.2 below for a breakdown of the land base by Management Unit and Site Class.

The British Columbia Forest Service made four assumptions in estimating the land base available for timber production in the Nelson Forest Region. They were: (1) that urban expansion would consume 109,000 hectares of the forested land base, reducing the land base available for sustained forest production to 3.65 million hectares; (2) that 36,000 hectares of the remaining 3.65 million were considered as economically inaccessible; (3) that

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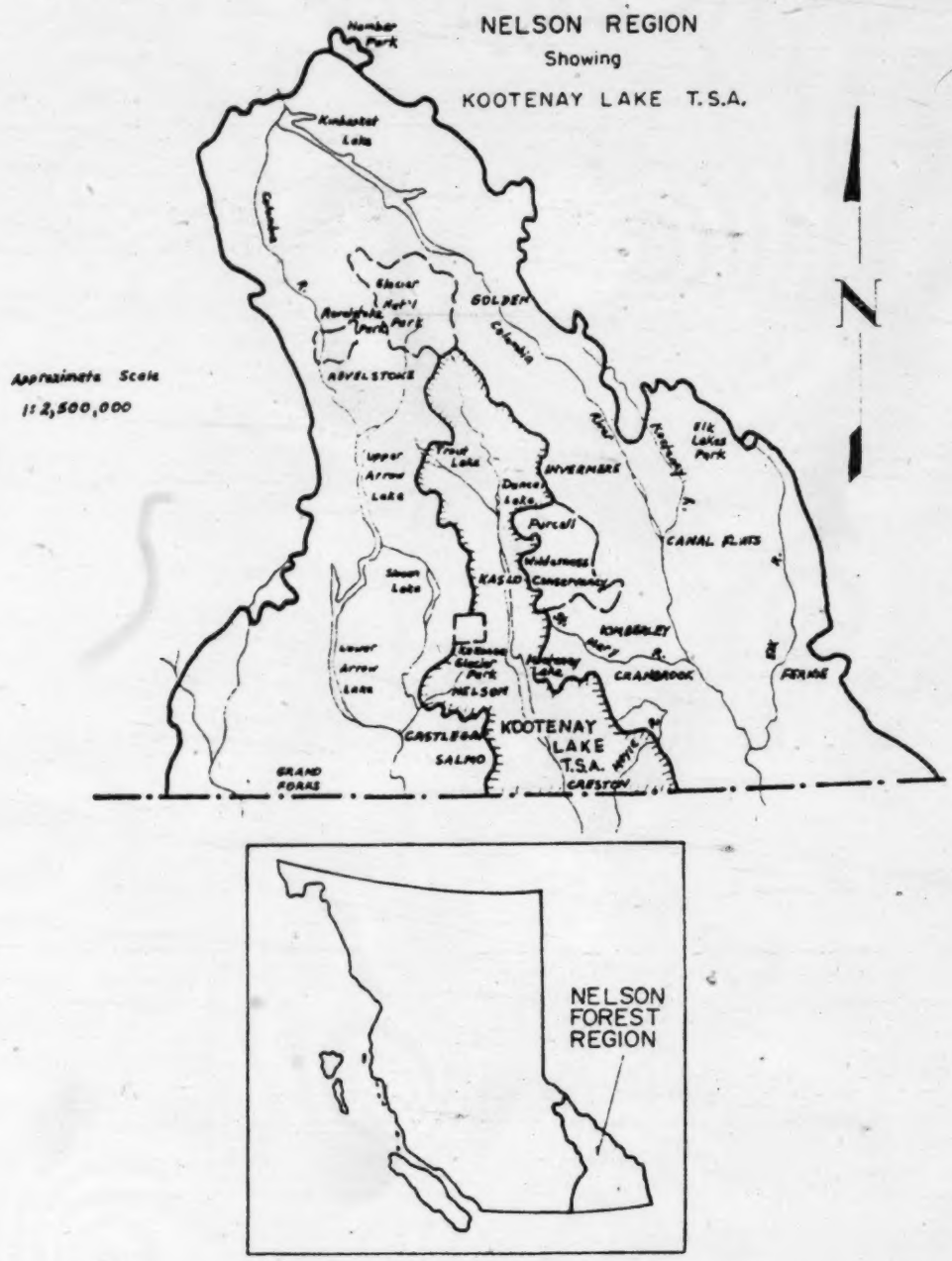
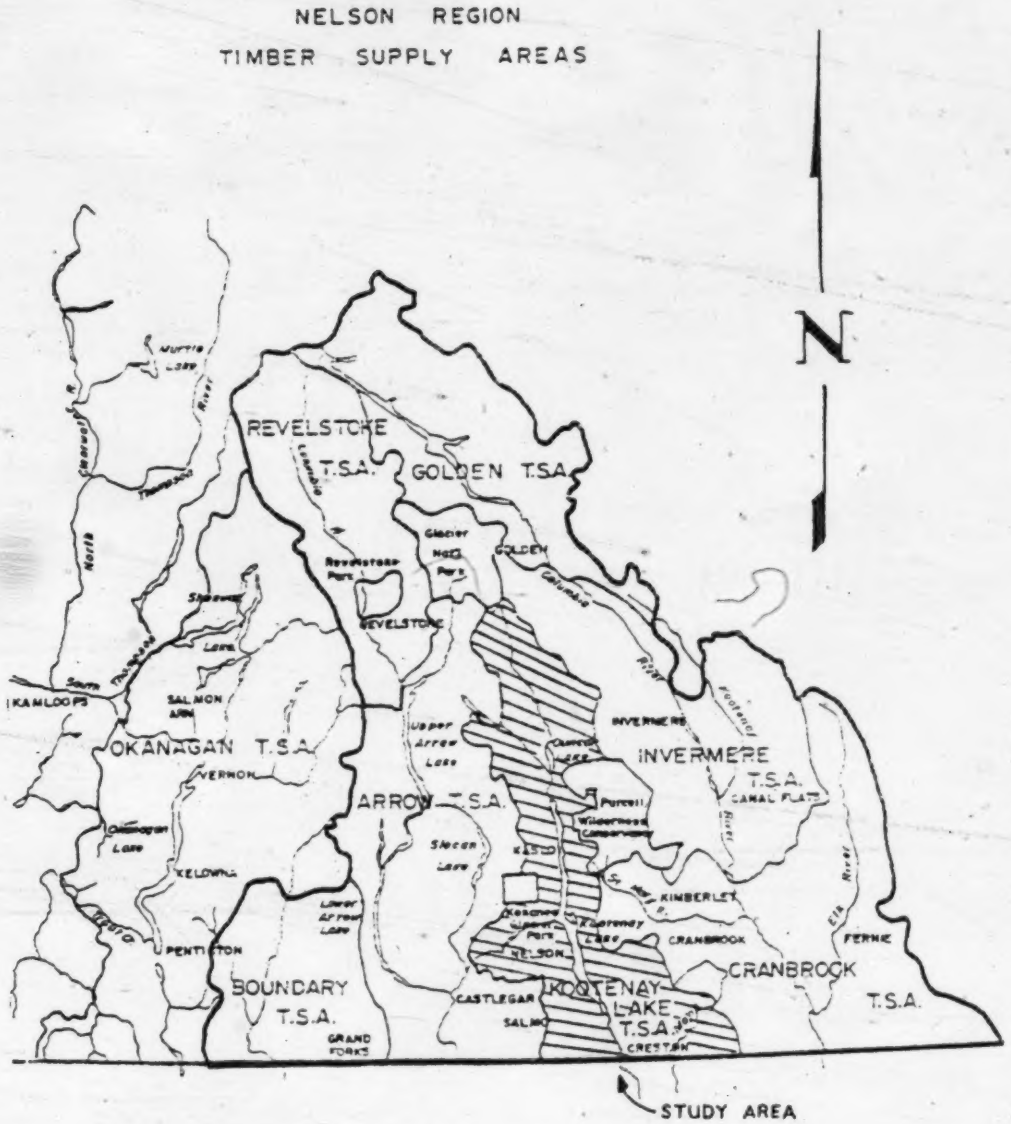
[20]Also defined as N.F.R.



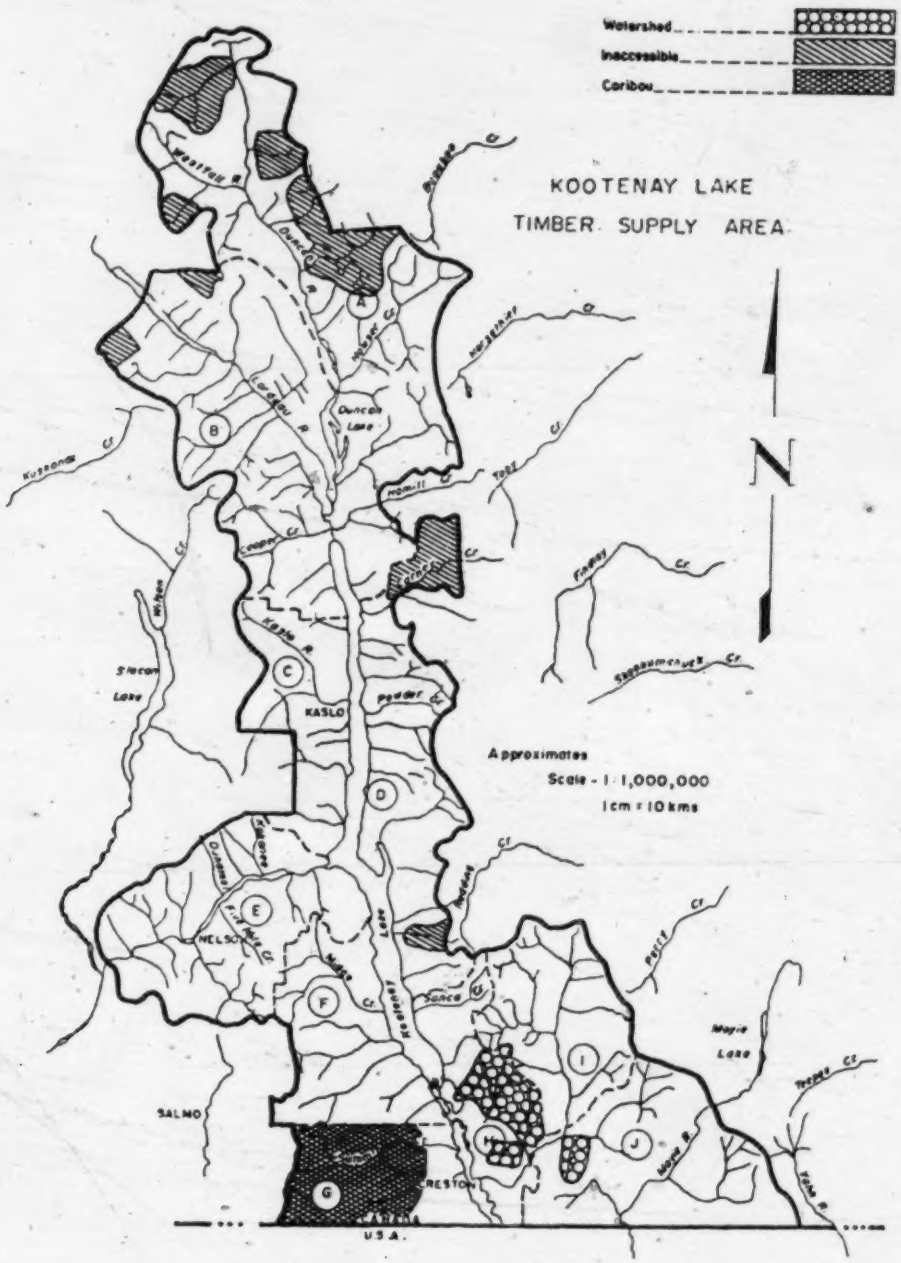
Source: B.C.F.S., Kootenay Lake T.S.A. Yield Analysis, 1980.

Plate 2.1 Nelson Forest Region and Kootenay Lake Timber Supply Area



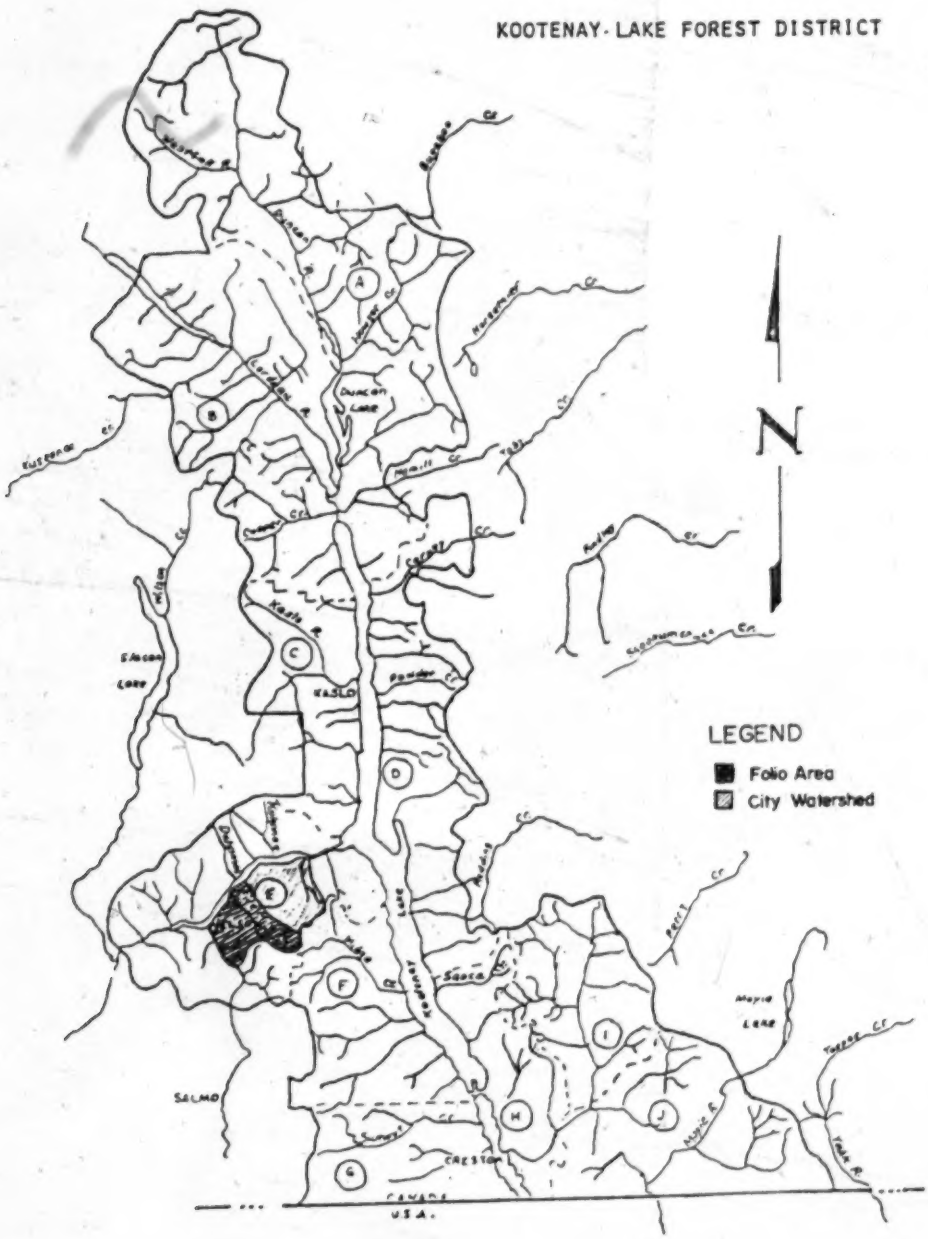
Source: B.C.F.S., Kootenay Lake T.S.A. Yield Analysis, 1980.

Plate 2.2 Nelson Forest Region Timber Supply Areas



Source: B.C.F.S., Kootenay Lake T.S.A. Yield Analysis, 1980.

Plate 2.3 Kootenay Lake Timber Supply Area



Source: Kootenay Lake T.S.A. Personnel, 1981.

Plate 2.4 The Nelson Watershed

environmentally sensitive areas would reduce the area of productive forest by 777,000 hectares; and (4) that other land withdrawals would amount to 57,000 hectares over the next 20 years and 153,000 hectares beyond 20 years.[21]

Parts of three mountain ranges make up elements of the Columbia Mountains in the Nelson Forest Region. These ranges are the Purcells in the east, the Selkirks between the Kootenay and Columbia Rivers and the Monashees in the southwest. In the south elevations rarely exceed 2000 meters and summits are characteristically rounded and well-forested. In the north a few peaks exceed 2700 meters and some isolated peaks and ridges are serrate. Some glaciers exist but are not as common as in the Rocky Mountains which border the N.F.R. to the east.

Valleys generally run north-south with valley bottoms normally at the 600 meter level. Valley sides are steep, rock outcrops are common and creeks are short and swift flowing. Geological formations are favourable for the occurance of numerous cold springs and a few hot springs. Lakes are long and relatively narrow and are bounded on either side by mountain peaks from 1700 to 2100 meters in height. Tributary creeks in narrow, deep valleys have formed a series of east-west ridges 2100 meters high around the lakes. The remaining important physiographic feature of the Region is the Creston Valley. It is the only extensive area that is not mountainous. The Creston Valley is located at the southern end of the south arm of Kootenay Lake, much of it is floodplain or diked, reclaimed agricultural land.

The three north-south mountain ranges have a great influence on the climate of the N.F.R. and generally it is quite varied. A dominant flow of westerly winds on the windward slopes of the mountains results in an annual level of precipitation of approximately 40 to 80 centimeters. The leeward side, i.e., the East Kootenays or Rocky Mountain Trench, receives very little precipitation (less than 50 cm./yr.) and can be classified as a semi-arid area.

Concentrating on the Central and West Kootenay areas (western part of N.F.R.), most valleys have warm summers, mild winters and moderate annual precipitation. Average daily

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[21]British Columbia Ministry of Forests, *Forest and Range Resources Analysis Technical Report,* (1980), 458.

Table 2.1 Nelson Forest Region-Land Base by Management Unit (ha.'s)

Management Unit	Productive Land	Non-Forest Land	Total Area	Alienated Land	Total
P.S.Y.U.'s	3 185 618	2 279 868	5 465 486	681 084	6 146 570
T.F.L.'s	578 095	776 093	1 354 188	-	1 354 188
Total	3 763 713	3 055 961	6 819 674	681 084	7 500 758

Source: British Columbia Ministry of Forests, Forest and Range Resources Analysis Technical Report, 1980, p. 456.
Note: T.F.L. = Tree Farm Licence

Table 2.2 Nelson Forest Region-Site Classes on Crown Lands*

Site Class	Area (ha.'s)	Total Productive Area (percent)
Good	412 279	11
Medium	1 948 833	52
Poor	1 277 349	34
Low	125 252	3
Total	3 763 713	100

Source: Ibid., p. 457.
* Includes T.F.L.'s

temperatures in January are about -4 degrees centigrade, while mean daily temperatures for July range from 17 to 21 degrees centigrade. Annual precipitation varies from 71 centimeters at Nelson and Trail to 48 centimeters at Creston. Two-thirds of the annual precipitation falls in the form of snow and annual snowfalls of 120 to 300 centimeters are normal.

Much of the Kootenay area is mountainous upland. In these areas summers are cool and short and winters are cold and long. The average daily temperature in these areas in January is -12 degrees centigrade and often below 13 degrees centigrade in July. At the higher elevations annual precipitation up to 150 centimeters is common and winter snowfall is normally more than 380 centimeters reaching 1500 centimeters occasionally. Strong winds along with thunderstorms and squalls are common in the Interior Wet Belt Region (central N.F.R.). Most of this kind of activity occurs during May to September.

The Canada Land Inventory classifies most of the soils of the Nelson Forest Region as having moderate to high capability for forest growth. Exceptions being areas classified as alpine. The most recent soil survey of Canada classified most of the Nelson Forest Region as having dominantly podzolic soils. More specifically humo-ferric podzols with significant lithic and stony phases. A soil sub-group, orthic humo-ferric podzol, is also relatively common. Typically these soils are found on steeply sloping mountains. The texture and character of the

parent material is stony, loamy to sandy glacial till, with some glaciofluvial deposits and colluvium. Geological formations are made up mainly of igneous and sedimentary rock.

The Nelson Forest Region is made up of three forest zones, the first is the Subalpine Zone, the second is the Columbia Forest Zone and the third is the Alpine Tundra Zone. The Alpine Tundra Zone occurs at approximately 1800 meters (timberline at 2000+ meters). Normally occurring vegetative cover is formed by dwarf willows, huckleberries and heaths. Flowering forbs such as arnicas, saxifrages and dryas are also common. Grasses, sedges and rushes frequently grow in the zone especially on alpine meadows. The Subalpine Forest Zone normally lies between the 1200 and 1800 meter levels. Subalpine Englemann spruce *(Picea englemannii)* and subalpine fir *(Abies lasiocarpa)* form the dominant association in the zone. Commonly occurring shrubs are the rhododendron, false azalia and a variety of huckleberries. The Columbia Forest Zone is made up of two sub-zones. On moist sites below 1200 meters interior western hemlock *(Tsuga hterophylla)* and western red cedar *(Thuja plicata)* form the dominant forest association with some grand fir *(Abies grandis)* and western white pine *(Pinus monticola)* intermixed. Common understory vegetation is made up of thimbleberry, devils club and Scoulers willow. Hebacious plant species commonly found are twinflowers and sarsaparilla. On drier sites interior Douglas fir *(Pseudotsuga menziesii* var. *glauca)*, western larch *(Larix occidentalis)* and Lodgepole pine *(Pinus contorta* var. *latifolia)* form the dominant association. Common understory shrubs are bearberry, saskatoon, ocean spray and flasebox. A number of herbacious plants like pine grass, fleabane and aster frequently grow on these drier sites. In southern valleys and along the Rocky Mountain Trench Douglas fir is common while mock orange is less common. Grassland species such as big sage, Idaho fescue, blue bunchgrass and wheatgrass thrive in these areas. Near valley bottoms on some moist sites, a Montane Forest Zone is occasionally found. The dominant tree species in this zone are Ponderosa pine *(Pinus ponderosa)* and interior Douglas fir. At the extreme southern end of the Rocky Mountain Trench a zone of Ponderosa pine can be found. In the Rocky Mountain area Lodgepole pine is common along with boreal white spruce *(Picea glauca)* and black spruce *(Picea mariana)*.

Black cottonwood *(Populus trichocarpa)* is common on floodplains; also, white birch *(Betula papyrifera)*, Douglas maple *(Acer glabrum* var. *douglasii)* and some trembling aspen *(Populus tremuloides)* can be found on a variety of lower elevation sites. Willow *(Salix* spp.) frequently grows on wetter sites along with alder *(Alnus* spp.) and red osier dogwood *(Cornus stolonifera)*.

The most accurate socioeconomic information on the Kootenay Lake T.S.A. and surrounding area can be found in, "An Economic Profile of the Regional District of Central Kootenay."[22] See Plate 4.1 which illustrates the area that the Regional District of Central Kootenay (R.D.C.K.) covers. The population of the Nelson Forest Region as of 1976 was 144,000 or six percent of British Columbia's total population . Trends indicate that the population growth rates in local areas range from three to ten percent. Some urban centres, e.g., Kaslo and Castlegar, have population growth rates of approximately ten percent, while some cities and towns have experienced a decline in population of between one to five percent (e.g., Nelson= -2.2%). Data also indicates that the rural growth rate which has been higher than the urban growth rate has caused a shift over the past five years from a 50-50 urban-rural population distribution to a 52 percent rural and 48 percent urban distribution.

2.3 Nelson Forest Region History

In the early 1900's agriculture was actively promoted in the N.F.R. but states the B.C. Ministry of Forests Technical Report (1980) "problems with irrigation, climate, disease and markets led to farm abandonment between the First and Second World Wars." [23] Some agricultural areas in the Central and West Kootenays namely Grand Forkes-Kettle Valley and Creston did survive; also during this period cattle ranching became the main form of agricultural activity in the East Kootenay.

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[22]Lauer, S., "An Economic Profile of the Regional District of Central Kootenay," *Regional District of Central Kootenay,* (1982), 285.
[23]Ministry of Forests Technical Report, p. 451.

During the 1950's the forest industry began to expand in British Columbia through the efforts of the B.C. Government. Incentives provided also revived the forest industry in the Nelson Forest Region. In 1961 Columbia Cellulose Limited built the N.F.R.'s first pulp mill at Castlegar, and in 1969 Crestbrook Forest Industries constructed a pulp mill at Skookumchuk in the north-eastern Kootenays. Both produced bleached kraft paper. Sawmills were later added on to the existing pulpmill facilities.

2.4 Regional Resources

This section describes the major resources of the Nelson Forest Region and Kootenay Lake Timber Supply Area.

2.4.1 Forestry

Growing stock is the volume of wood available as defined by Ministry of Forests utilization standards, and are defined as, minimum trunk diameter at breast height = 17.5 centimeters, stump height = 30.5 centimeters and top diameter = 10.2 centimeters. To describe stand composition tree species are described by inventory type. Ten broad categories of species groups were defined: (1) fir, (2) cedar, (3) hemlock, (4) balsam fir, (5) spruce, (6) white pine, (7) lodgepole pine, (8) yellow or Ponderosa pine, (9) larch and (10) deciduous. Figure 2.1 displays the productive area of mature/immature timber for each species group and Figure 2.2 displays the productive area by age group for each of the species groups. Table 2.3 shows the distribution of gross tree volume for each species group for mature timber only (note, 340 million meters cubed is 5% of the total provincial gross mature volume).

Table 2.4 displays the importance of N.S.R. area in the Nelson Forest Region in relation to the other seven B.C Forest Regions. For a more detailed breakdown of N.S.R. areas in the Nelson Forest Region see Table A.1 in Appendix A. The size and proportion of the total P.S.Y.U. Backlog N.S.R. area in the Nelson Forest Region relative to the other B.C. Regions is of critical importance and is discussed to a greater extent later in the chapter. There are

Table 2.3 Nelson Forest Region-Volume of Mature Timber on Crown Lands

Species Groups	Volume (m^3)
Fir	29 155 032
Cedar	31 568 125
Hemlock	47 687 568
Balsam	52 268 287
Spruce	118 161 266
Lodgepole pine	44 978 082
Larch	10 092 468
Deciduous	846 814
White pine	5 234 654
Yellow pine	127 384
Total	340 119 680

Source: Ibid., p. 461.

significant areas of non-commercial timber (e.g., deciduous species), stagnant, overstocked and overmature stands which are not fully productive. Only combined P.S.Y.U. and T.F.L. (Tree Farm Licence) data is available on these three kinds of areas. The data indicates that: (1) non-commercial timber on poor and low quality sites is 4,445 hectares in area; (2) there are 194,500 hectares of overmature timber (mainly coniferous species); and (3) 30,000 hectares of stagnant and/or overstocked stands consisting mainly of cedar, hemlock or lodgepole pine.

2.4.2 Forest Industry Requirements, Infrastructure and Wood Use

Table A.2 in Appendix A provides an insight into the growth of the forest industry in the Nelson Forest Region since 1960. Table 2.5 illustrates the annual wood requirements of the solid wood industry in the N.F.R. Similarly, Table 2.6 shows the annual wood requirements of the Nelson Forest Regions' pulp mills. In total, annual regional forest industry demand (at capacity) is 8.4 million meters cubed of logs and pulpwood plus 0.5 million B.D.U.'s (Bone Dry Units-see bottom of Table 2.6 for definition) of by-product chips.

Ninety-nine percent of total log production in the Nelson Forest Region was handled by 27 operators. Seventy-three percent of the 1977 cut came from P.S.Y.U.'s and 27 percent came from T.F.L.'s.[24] A noteworthy point is that only four percent of total wood production in 1977 came from sources on privately owned land, which emphasizes the dependence that the forest industry has upon wood from public lands in the Nelson Forest Region. According to the Ministry of Forests Technical Report (1980), "assuming a two percent annual increase in log consumption over the next decade and no increase in the following decade, the industrial wood requirements on public lands administered directly by the Ministry of Forests will be approximately 5.3 million cubic meters per year by 1987."[25]

2.4.3 Range

The Nelson Forest Region has 1.5 million hectares of range land of which 840,000 hectares are designated as usable. The East Kootenay area has 350,000 hectares of range land mainly in the Rocky Mountain Trench, while the West Kootenay area has 490,000 hectares of range land concentrated in the Arrow Lakes and Kettle River drainages. Weed invasions, land alienation and forest regeneration are predicted to reduce the use of N.F.R. Crown ranges in the future.

2.4.4 Recreation

A key recreational attribute of the N.F.R. is its scenic value. There are many mountains and lakes, where numerous recreational activities can be enjoyed. Forestry and mining roads of varying quality make a number of areas with recreation potential easily accessible (motorized or self-propelled) to the public. There are conflicts between users of recreation resources and other resources for land use priority along with some temporary and permanent withdrawals from the recreational land base. However, the Ministry of Forests projects that the supply of recreational land will not be over utilized except in certain local

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[24]Ibid., p. 469
[25]Ibid.

Table 2.4 British Columbia N.S.R. Areas (P.S.Y.U.'s only)

Forest Region	Total Productive Forest Land** (ha.'s)	Backlog N.S.R.** (ha.'s)	Backlog N.S.R.** (%)	T.P.F.L.* (ha.'s)	T.P.F.L.* (%)	Backlog N.S.R. Sites* (ha.'s)	Backlog N.S.R. Sites* (%)
Vancouver	3 824 734	37 258	0.97	1 604 616	42	28 392	1.77
Nelson	3 763 713	171 991	4.57	2 361 102	63	105 749	4.48
Buckley North-West	8 329 424	237 645	2.85	2 350 295	28	8 356	0.36
Prince George	8 623 881	57 893	0.67	5 223 132	61	56 309	1.08
Prince Rupert	3 335 147	26 335	0.79	587 075	27	13 018	2.22
Caribou	6 476 097	63 004	0.97	2 198 967	34	33 298	1.51
Kamloops	4 387 658	40 794	0.93	2 583 707	59	23 292	0.90
Peace River	8 672 948	9 258	0.11	2 649 666	30	8 129	0.31
Total	47 413 602	644 178	-	19 558 560	-	276 543	-

Source: Ibid., various pages.
* Good and Medium Sites
** Good, Medium, Poor and Low Sites

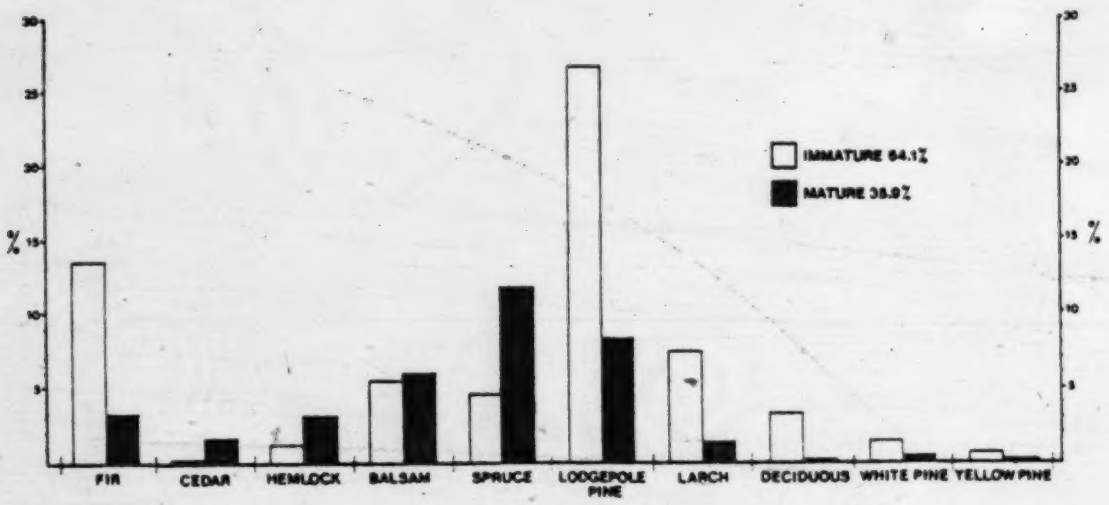
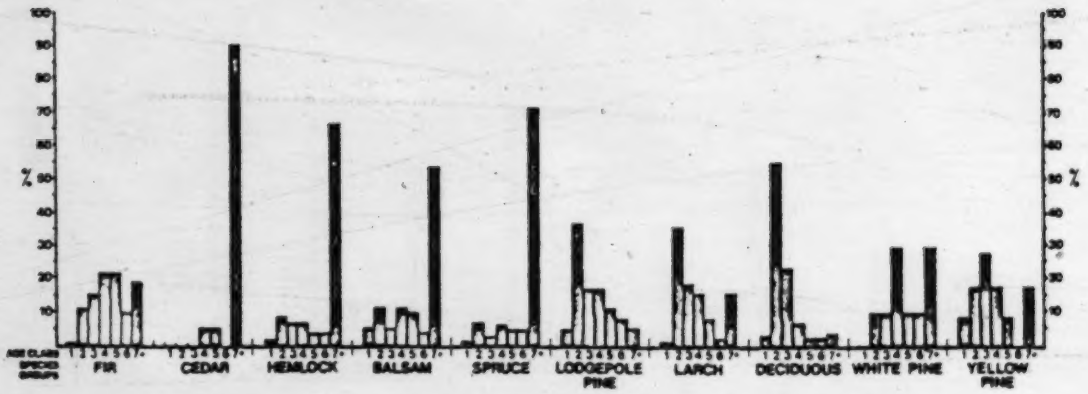


Figure 2.1 Productive Area of Immature/Mature Timber for Crown Lands by 10 Major Species Groups



Source: B.C.F.S., Technical Report, 1980, pp. 460-461.

Figure 2.2 Productive Area by Age Class for Crown Lands by 10 Major Species Groups

Table 2.5 Nelson Forest Region-Annual Forest Industry Wood Requirements Based on Installed Capacity (1977, m^3)

Timber Supply Areas	Sawmills	Veneer and Plywood	Other*	Total	Potential Chip Production(BDU's)
Boundary	743 300	-	17 000	760 300	86 000
Arrow	1 857 600	164 200	101 900	2 123 700	240 000
Kootenay Lake	628 000	351 000	79 000	1 058 000	120 000
Cranbrook	1 404 000	-	28 000	1 432 000	162 000
Invermere	1 050 500	-	181 000	1 231 500	139 000
Golden	583 000	224 000	108 000	915 000	103 000
Revelstoke	354 000	-	71 000	425 000	48 000
Total	6 620 400	739 200	585 900	7 945 500	898 000

Source: Ibid., p. 468.
* Portable sawmills and pole plants, with no barking or chipping facilities.

Table 2.6 Nelson Forest Region-Annual Pulp Mill Wood Requirements Based on Installed Capacity (1977, m^3)

Site	Capacity (tonnes)	Wood Usage*		Total** (000's of m^3)
		Roundwood (m^3)	Chips (BDU's)	
Castlegar	195 000 (kraft-B.C Timber)	481 000	196 000	1 000
Skookumchuck	138 000 (kraft-C.F.I.)	-	300 000	900
Totals	333 000 (bleached kraft pulp)	481 000	496 000	1 900

* Approximate usage in 1978 -
** Roundwood equivalent: assume 1 BDU equals 2.832 (m^3)

areas during periods of peak use.

The Ministry of Forests Technical Report (1980) states that "estimates . . . based on site questionnaires and field staff observation suggested that 180,000 people per year participated in some form of recreation activity and that 110,000 of these used Ministry of Forests sites and trails."[26] Forty-five percent of the participants were permanent regional residents, while, the rest were from elsewhere. The major uses (65% of total recreation use) were camping (235 sites and 1,300 individual campsites)and picnicking plus associated activities. The remaining 35 percent was made up of hiking (115 km. summer use and 25 km. winter use trails), canoeing, cross-country and downhill skiing, snowmobiling, viewing, hunting, snowshoing and fishing. Because of accessibility constraints, most of the recreational use takes place within 100 kilometers of major regional urban centres. Camping and picnicking activities occur mainly along the lakes, rivers and creeks, while, boating activities are centred on the large lakes and rivers in the region. Winter activities are popular but are generally restricted to easily accessible lands surrounding urban areas.

2.4.5 Parks, Ecological Reserves and Wilderness Areas

There are 47 small parks of less than 1,000 hectares (total area 4,686 ha's.) in the region, plus ten other parks which total 248,331 hectares, six of which are between 1,000 and 10,000 hectares and the other four ranging from 24,000 to 132,000 hectares in size.

There are four recreation areas totalling 33,688 hectares ranging in size from 140 to 25,000 hectares. There is one wilderness area in the region. The Purcell Wilderness Conservancy is 131,523 hectares in size and is located in a relatively inaccessible area of the Nelson Forest Region, approximately 40 kilometers northwest of Kimberley and 65 kilometers northeast of the city of Nelson. In terms of ecological reserves, as of 1978 (Krajina and Carson, 1978)[27] there were six ecological reserves in the Nelson Forest Region, totalling 3,348 hectares (see Table A.3

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[26]Ibid., p. 478.
[27]Krajina, V.J. and T. Carson, *Ecological Reserves in British Columbia*, (Victoria, B.C.: Ecological Reserves Unit, Ministry of Environment, 1978).

in Appendix A). Access into these reserves is limited.

2.4.6 Community Water Supplies

The Nelson Forest Region has 93 established community watersheds covering approximately 5,270 square kilometers. Seven Regional Water Districts take in the 93 watersheds. Table A.5 in Appendix A gives a breakdown of the distribution of watersheds into districts and the total drainage area per district.

2.4.7 Agriculture in the West and East Kootenay

Most agricultural activity in the Central and West Kootenay areas occurs in the Creston and Grand Forkes-Kettle Valley locales. Major cash crops in the Creston area according to the Ministry of Forests Technical Report (1980) include "grain, potatoes, field peas, beans, forage seeds and tame hay. Tree fruits and berries are the main crops on the benchlands, surrounding Creston Flats. There is also an important dairy industry to the south of the Flats on land less suited for cultivation."[23] As is the case in the East Kootenay, cattle ranching in the Grand Forks-Kettle Valley area is the major agricultural activity. Other crops include, potatoes, sweet corn, onions and asparagus. Some dairy and poultry farms and a few apple orchards can also be found near Grand Forks. Physical (soils, topography and climate) constraints limit agriculture in the East Kootenay mainly to cattle ranching.

Between the period 1961 to 1971 total farm area in the Nelson Forest Region increased by 8,000 hectares to 18,000 hectares. This was a result of land clearing, conversion and crop change overs. A direct result of these changes was an increase in the number of land use conflicts with the existing wildlife population, particularly in the area surrounding Cranbrooke in the East Kootenay.

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[23]British Columbia Ministry of Forests Technical Report, p. 481.

2.4.8 Minerals

Mining activity contributed greatly to the development of the Nelson Forest Region. Large reserves of coal have led to the development of large coal mining areas in the East Kootenay. As a result new communities were established along with more efficient transportation systems. The new communities and transportation systems also contributed to the development of other sectors in the region. Some mining activity (open pit and shaft) does occur in the West Kootenay. However, the size and number of mining developments in the West Kootenay are smaller than in the East Kootenay. Some land use conflicts have arisen where domestic water supplies have been affected as a result of active prospecting for mineral deposits.

2.4.9 Hydroelectric Power and Electric Power Transmission Lines

The construction of a number of hydroelectric generation dams and reservoirs in the N.F.R. has removed a considerable amount of productive agricultural and forest land from the region's total land base. The existing dams are Mica, Hugh Keenleyside, High Arrow, Duncan and Revelstoke (soon to be completed). The Ministry of Forests Report (1980) states that "McNaughton Lake, Duncan Lake and Revelstoke Reservoir have removed significant areas of land from timber production. Land flooded by the Arrow Lakes and Lake Koocanusa was primarily agricultural and caused little loss of productive forest land." [29]

Because of the large number of dams in the N.F.R. there is an extensive network of transmission lines with other lines proposed for construction in the future. These lines permanently remove a considerable area of land from timber production and have contributed to constraints on timber supply in the region.

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[29]Ibid., p. 482.

2.4.10 Wildlife

According to the Ministry of Forests Technical Report (1980) there are "11 species of big game, 15 species of small game and fur bearing animals and a large variety of upland gamebirds and migratory waterfowl"[30] in the N.F.R. Estimates indicate that 90 percent of the Rocky Mountain Sheep, 75 percent of the white-tailed deer and 60 percent of the the elk existing in British Columbia survive there.

Within the discussion of wildlife management in the N.F.R. the Ministry of Forests Technical Report (1980) indicates that "management options have been severely curtailed by land alienations for hydro developments and for recreational cottage subdivisions. Huge tracts of valley bottom lands which once served as critical winter range have been lost, placing even higher priority on retaining remaining areas."[31]

2.4.11 Fisheries

There are three main types of fish habitat in the Nelson Forest Region, in the form of: (1) streams or creeks, (2) small lakes and (3) large reservoirs and lakes. Streams in the region are generally unproductive because of habitat alterations, over-fishing and physical constraints. The main causes of over-fishing and habitat alteration have stemmed from improved access to fishery areas and increased industrial expansion. The Nelson Forest Region has 12 lakes larger than 600 hectares and six large impoundments resulting from hydroelectric and flood-control dam construction. The large lakes contain species of Dolly Varden char, Kokanee salmon and Rainbow trout. Other water systems contain fish complexes such as Yellowstone cutthroat trout, Dolly Varden char and Rocky Mountain whitefish. Rivers in the region are generally managed as spawning and rearing areas, while tributary streams connected to large lakes or reservoirs are also managed with the same purpose in mind. For example, a number of streams empty into the Kootenay Lake, which is one of the largest and most popular year-round fishing lakes in the Nelson Forest Region. Because these streams or creeks are managed, the resident

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[30]Ibid., p. 483.
[31]Ibid.

fish population in Kootenay Lake can generally be maintained.

2.5 Kootenay Lake Timber Supply Area

This section describes the resources of the Kootenay Lake Forest District or T.S.A. The Kootenay Lake T.S.A. is a long and narrow area which has two mountain ranges, the Purcells in the east and the Selkirks in the west, which run along it in a north-south direction. Kootenay and Duncan Lakes lie in a valley created by these mountain ranges. The Kootenay Lake T.S.A. covers 1,137,166 hectares. Fifty- three percent of this total area is Crown forest. As is the case with other T.S.A.'s in British Columbia, the Kootenay Lake boundaries were defined using transportation cost and topographic criteria. Geographic constraints in the T.S.A. force woodflow into a number of concentrated milling centres. These centres are found in either of the Lardeau or Creston Public Sustained Yield Units (P.S.Y.U.'s). The T.S.A. is divided into ten Supply Blocks generally for allocative and administrative purposes. According to the B.C.F.S. Kootenay Lake T.S.A. Yield Analysis (1980) "each Supply Block was chosen as a homogeneous area with respect to transportation route, forest and harvesting characteristics."[32] The total T.S.A. combined sawmill and veneer mill log requirement is 1.5 million cubic meters per year. Sawmills are locted in Creston, Erickson, Wynndel, Nelson, Crawford Bay, Kaslo and Cooper Creek. Veneer mills are located at Nelson and Creston. The mills directly create 964 jobs and 1,446 jobs indirectly. Estimated total sales for 1980 were 50 million dollars. Table 2.7 below shows the current (1980) timber allocation for the T.S.A. Small mills without a timber allocation consumed 64,000 cubic meters of timber. Other timber harvested for shakes, shingles and posts totalled 21,000 cubic meters for the same mills. Generally, the mills in the Kootenay T.S.A. are not equipped to handle: (1) small diameter logs (8-15 cm. D.B.H.) and (2) shell timber (centre rot, ring sound wood). This constraint on equipment is a major factor in the inability of the local forest industry to increase the supply of wood available at present.

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[32]British Columbia Ministry of Forests, *Kootenay Lake Timber Supply Area Yield Analysis*, (1980), 5.

Table 2.7 Kootenay Lake T.S.A.-Current Timber Allocation (m')

Licensee	Creston P.S.Y.U		Lardeau P.S.Y.U	Total T.S.A.
	Quota Plus Close Utilization	Additional (Third Brand)	Quota Plus Close Utilization	
Crestbrook Forest Ind. Ltd.	72 500	54 370	29 670	156 540
Davidson, E.M.	-	-	1 020	1 020
Hamill Cr. Holdings Ltd.	-	-	40	40
Kootenay Forest Products	37 570	-	319 900	357 470
Lake, A.E. & Estate of S.G. Lake	-	-	80	80
Tarr, C.A.	-	-	260	260
Tencza, J.A.	-	-	5 590	5 590
Thomas & Howlett Hold. Ltd.	-	-	38 060	38 060
Celcrest Timber Ltd.	6 530	4 900	-	11 430
Celcrest Timber Ltd., Lavola Logging Ltd. and Wynndel Box & Lumber Ltd.	-	-	20 470	20 470
Wynndel Box & Lumber Ltd.	32 320	34 410	-	66 730
Everitt, W.	300	-	-	300
Huscroft, J.H. & Huscroft Logging Co. Ltd.	28 170	26 080	-	54 250
Louisa A. Miller, Executrix of Estate of J. Miller	40	-	-	40
Total	177 430	119 760	415 090	712 280

Source: British Columbia Ministry of Forests Kootenay Lake T.S.A. Analysis, p. 31.

2.5.1 Nelson Watershed Description

The Nelson Watershed lies at the eastern end of the west-arm of Kootenay Lake. It is immediately adjacent to the City of Nelson, ranging from approximately 20 to 150 degrees on a compass heading. The watershed covers approximately 17,854 hectares of predominantly forested land, its boundaries are the high points of land that delineate creek sub-drainages. The watershed is part of Supply Block E in the Lardeau P.S.Y.U., and is publicly owned and administered by the B.C.F.S. Only a small part of the western side of the Nelson Watershed has been selectively harvested for timber. Presently the area is allocated to B.C. Timber's -Kootenay Forest Products Division. Privately owned forest land lies adjacent to the watershed on the western side but no harvesting activity has as yet occurred on that land.

2.6 Kootenay Lake T.S.A and Nelson Watershed Timber Supply

2.6.1 Kootenay Lake T.S.A.

Table 2.8 displays the breakdown of productive forest area by P.S.Y.U. for the T.S.A. The dates of inventory should be noted (1969 and 1973) because there have been changes in the forest (logging, restocking, insufficient regeneration, growth, mortality and land alienation) since those inventories were completed. The most accurate data is short-term (next 20 years). Figures 2.3 and 2.4 show the short-term volume distribution by species and age group respectively for the Kootenay Lake T.S.A.

2.6.2 Nelson Watershed

The mature volume available in the Nelson Watershed was grown 20 years with TIMBER RAM (Timber Resource Allocation Model) using the 1969 inventory data as a starting point. These volumes are summarized in Tables 2.9, 2.10 and 2.11 below. Table 2.9 gives the 1969 base data on a sub-drainage basis, Table 2.10 shows the same forest grown ten years to 1979 and Table 2.11 shows the sub-drainage volume for the Watershed grown ten more

Table 2.8 Kootenay Lake T.S.A.-P.S.Y.U. Classification (ha.'s)

Status of Land	Creston P.S.Y.U. (1973)*	Lardeau P.S.Y.U. (1969)*	Total
Alienated	40 420	22 339	62 759
Crown-non forest	65 677	403 934	469 611
Crown-non productive forest	209 109	395 687	604 796
Total	315 206	821 960	1 137 166
Productive Forest			
Mature**	41 400	162 558	203 958
Immature	154 811	208 853	363 665
Residual	392	1 399	1 790
N.S.R.	7 548	22 408	29 956
Non-commercial	4 958	469	5 427
Total	209 109	395 687	604 796

Source: Ibid, p. 32.
* Date of Inventory ** Lodgepole pine over 80 years, other species over 120 years.

years to 1989. All of the tables breakdown the volume per sub-drainage by species group. The assumptions that were used to grow the forest can be found in Appendix B. Total volume for the Nelson Watershed is summarized in Table 2.12.

2.6.3 Denuded or N.S.R. Areas

According to the Kootenay Lake T.S.A. Analysis (1980) "an N.S.R. area is one that has been more than 75 percent disturbed by fire, logging, etc. and has not been restocked to an acceptable level with commercial species."[11] There are approximately 27,978 hectares of land classified as N.S.R. in the Kootenay Lake T.S.A. This area is approximately 16 percent of the total N.S.R. area for the Nelson Forest Region. The site breakdown is 1,100 hectares on good

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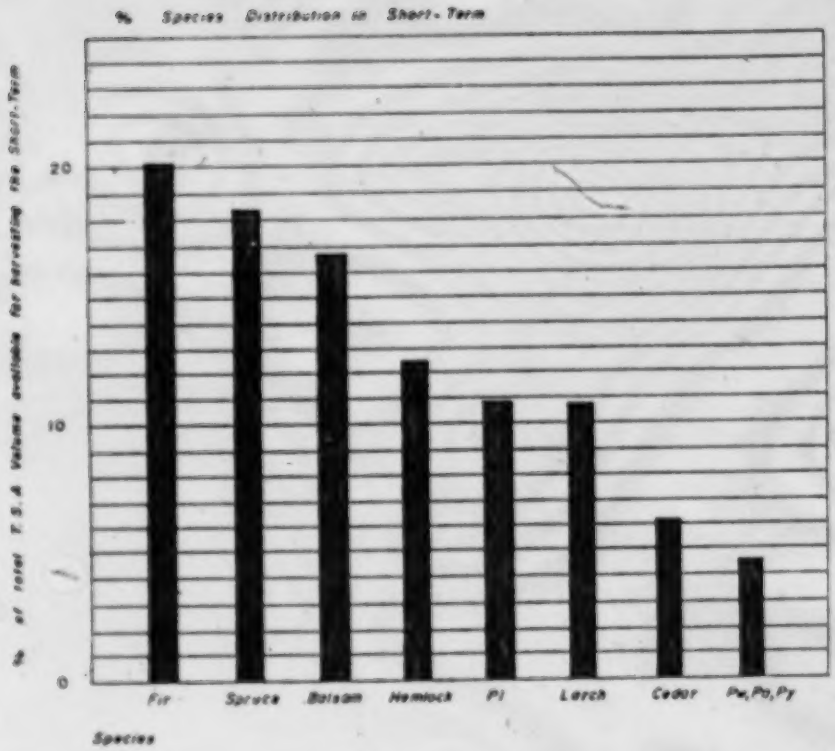
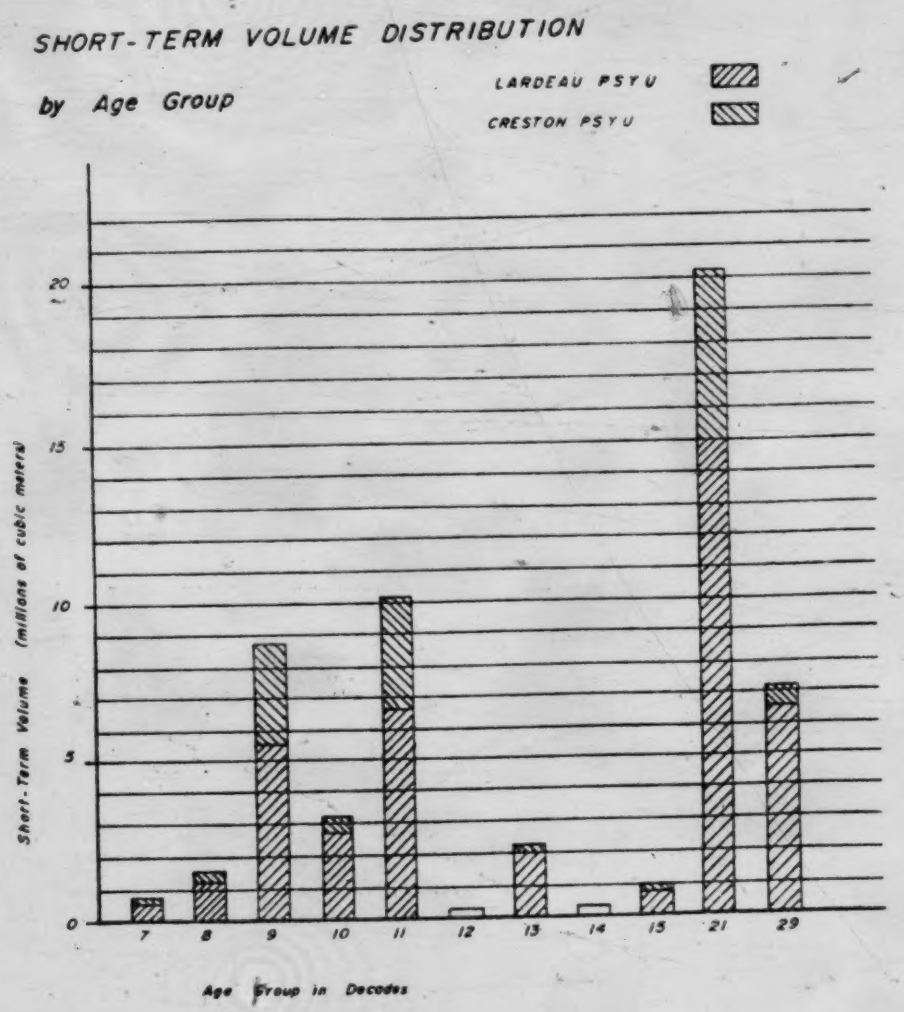
[11]Ibid., p. 41.



Source: B.C.F.S., Kootenay Lake T.S.A. Yield Analysis, 1980, p. 13.

Figure 2.3 Kootenay Lake T.S.A. Short-term Species Distribution



Source: B.C.F.S., Yield Analysis, 1980, p. 14.

Figure 2.4 Kootenay Lake T.S.A. Short-term Volume Distribution

Table 2.9 Nelson Watershed Volumes (1969 Inventory) by Sub-drainage (m^3)

Species	Selous Cr.	Ward Cr.	Anderson & Fell Cr.'s	Hermitage Cr.	5-Mile Cr.	Turnstall & 8-Mile Cr.'s	Lasca Cr.	Total for Species
F	-	-	-	18 080.0	2 239.4	830.5	47 885.8	69 035.7
L	-	-	-	-	-	-	211.1	211.1
C	-	-	-	-	-	504.4	76 150.5	76 654.9
H	-	1 060.8	10 607.1	-	1 919.2	19 002.6	20 177.8	52 767.5
Pl	2 698.8	-	35 637.8	60 312.3	95 156.4	62 755.6	154 490.5	411 051.4
Pw	-	-	-	-	-	-	6 504.0	6 504.0
S	73 374.8	-	24 985.7	508.9	219 586.4	26 686.2	143 537.8	488 679.8
B	11 846.1	-	755.0	-	42 193.2	30 581.6	36 785.6	122 161.5
Total	87 919.7	1 060.8	71 985.6	78 901.2	361 094.6	140 360.9	485 743.1	1 227 065.9

Source: British Columbia Forest Service Kootenay Lake T.S.A unpublished data, 1982.

Table 2.10 Nelson Watershed Volumes (grown to 1979) by Sub-drainage (m^3)*

Species	Selous Cr.	Ward Cr.	Anderson & Fell Cr.'s	Hermitage Cr.	5-Mile Cr.	Turnstall & 8-Mile Cr.'s	Lasca Cr.	Total for Species
F	22 460.4	36 846.8	1 468.0	15 120.4	10 980.6	14 107.5	21 592.1	122 575.8
L	-	-	-	-	12 977.2	880.8	44 694.1	58 552.1
C	-	-	-	-	-	2 006.9	-	2 006.9
H	-	-	-	-	-	31 221.8	509.5	31 731.3
Pl	8 123.0	5 566.6	21 238.8	-	32 409.6	43 696.5	30 188.6	141 496.1
Pw	-	-	-	-	3 086.3	-	9 663.3	12 749.6
S	465.4	-	-	-	11 861.4	17 423.3	13 523.5	43 273.6
B	-	-	-	-	2 642.4	8 051.2	16 215.7	26 909.3
Total	31 048.8	42 413.4	22 706.8	15 120.4	73 957.5	117 388.0	136 386.8	439 021.7

Source: Ibid.
* The volumes presented represent forest growth over the 1969 to 1979 period only.

Table 2.11 Nelson Watershed Volumes (grown to 1989) by Sub-drainage (m^3)*

Species	Selous Cr.	Ward Cr.	Anderson & Fell Cr.'s	Hermitage Cr.	5-Mile Cr.	Turnstall & 8-Mile Cr.'s	Lasca Cr.	Total for Species
F	27 003.5	36 846.8	5 169.1	29 065.3	12 336.0	39 481.6	47 229.8	197 132.1
L	-	-	20 340.8	555.7	26 851.5	4 217.9	55 028.3	116 994.2
C	-	-	-	-	2 355.5	2 006.9	-	4 362.4
H	-	-	-	-	-	33 221.8	509.2	33 731.3
Pl	8 123.0	5 556.6	21 396.1	445.7	32 409.6	44 001.0	35 364.1	147 306.1
Pw	-	-	-	-	4 276.5	-	9 722.9	13 999.4
S	465.4	-	-	-	11 861.4	18 038.5	13 738.8	44 104.1
B	-	-	-	-	4 826.3	8 051.2	16 436.4	29 313.9
Total	35 591.9	42 413.4	46 906.0	30 066.7	94 916.8	149 018.9	178 029.8	586 943.5

Source: Ibid.
* The volumes presented represent forest growth over the 1979 to 1989 period only.

Table 2.12 Total Nelson Watershed Volumes (to 1989) by Sub-drainage (m³)*

Species	Selous Cr.	Ward Cr.	Anderson & Fell Cr.'s	Hermitage Cr.	5-Mile Cr.	Turnstall & 8-Mile Cr.'s	Lasca Cr.	Total for Species
F	49 463.9	73 693.6	6 637.1	62 265.7	25 556.0	54 419.6	116 707.7	388 743.6
L	-	-	20 340.8	555.7	49 828.7	5 098.7	99 933.5	175 757.2
C	-	-	-	-	2 355.5	4 518.2	76 150.5	83 024.2
H	-	1 060.8	10 607.1	-	1 919.2	83 446.2	21 196.5	118 230.1
Pl	18 944.8	11 133.2	78 272.7	60 758.0	159 975.6	150 726.1	220 043.2	699 853.6
Pw	-	-	-	-	7 362.8	-	25 890.2	33 253.0
S	74 305.6	-	24 985.7	508.9	243 309.2	62 148.0	170 800.1	576 057.5
B	11 846.1	-	755.0	-	49 661.9	46 684.0	69 437.7	178 384.7
Total	154 560.4	85 887.6	141 598.4	124 088.3	529 968.9	406 767.8	800 159.4	2 243 030.8

Source: Ibid.
* The volumes presented represent total forest growth from 1969 to 1989 plus the existing 1969 inventory volume.

sites, 17,952 hectares on medium sites (the majority of logging takes place on these sites) and 8,926 hectares on poor sites. The total N.S.R. area figure may be revised as a result of on going regeneration surveys.[34] At the present time there are no N.S.R. areas in the Nelson Watershed.

2.6.4 Problem Forest Types

The Kootenay Lake T.S.A. has an estimated 5,600 hectares of overmature balsam fir and spruce stands which contain approximately 1.4 million cubic meters of timber. The stands are generally situated in areas difficult to access (high altitudes and/or steep slopes) throughout the T.S.A. There are also approximately 16,000 hectares of highly decadent western hemlock and western red cedar stands in the T.S.A. which contain roughly 6.5 million cubic meters of timber. A great deal of this timber may not be recoverable because of deterioration and the lack of equipment in the local mills to process the logs. In 40 percent of the area covered by these kinds of stands access is also problem because of slope steepness. There are 10,000 hectares of immature stagnant larch, fir and lodgepole pine in the T.S.A. Some areas of (no figure available) immature stagnant hemlock-cedar and spruce-balsam species can also be found in the T.S.A. but are less common.

There are approximately 2,850 hectares of overmature balsam-spruce stands in the Nelson Watershed. They contain roughly 0.71 million cubic meters of timber. Generally, this type is found in areas difficult to access at higher elevations in the watershed. Some of the these types can also be found near the headwaters of some of the major creeks. The Nelson Watershed also has approximately 292 hectares of decadent hemlock-cedar stands. This area contains about 0.12 million cubic meters of wood. Most of this volume is situated along creeks and in creek headwaters and is moderately easy to access. No figures were available on the extent of stagnant stands in the Nelson Watershed.

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[34]Note: the total number of hectares of N.S.R. above and in Table 2.8 differ as a result of an ongoing update.

2.7 Water Resources

With increased clearing of forested land and the subdivision of land once on the Agricultural Land Reserve, the importance of water resources is now becoming apparent to many individuals, especially those living in or adjacent to major urban centres. Disturbances in the water supply caused by clearing, construction (houses and roads), timber harvesting and mineral exploration occur often in the T.S.A. Much of the precipitation that falls in the area flows down the mountain slopes and eventually enters into Kootenay or Duncan Lakes. Few people, except perhaps lake front land owners, use the lake water because of water odor and relatively poor taste, especially near urban areas. Consequently, the people living on the lower mountain slopes are, at present, highly dependent upon the water flow from higher altitudes and are very vulnerable to disturbances, i.e., from any logging, mining and road construction activity above them. This scenario also applies to individuals who obtain their water from creeks, springs and wells.

The City of Nelson, population approximately 10,000 depends upon the surface flow of five drainage basins for a large part of its water. The creeks flowing out of each basin are named Five Mile, Fell, Anderson, Ward and Selous. All of these creeks are located in the Nelson Watershed. A joint B.C.F.S -Selkirk College Report (1980) states that "the combined late summer flow of these creeks" as elsewhere in the T.S.A, "is insufficient to meet the full domestic and irrigation needs of Nelson, especially in dry years." [35] The City of Nelson and rural water users are licenced by the Water Rights Branch of the Ministry of Environment to draw water from these five creeks (see Table A.6 in Appendix A). The land making up the Nelson Watershed is within the Lardeau P.S.Y.U. and is Crown (provincially owned) land administered by the British Columbia Ministry of Forests. Thus, states the Selkirk Report (1980), "the forest lands of the watershed are formally committed to provide both water and timber but with the management responsibility resting legally with the Ministry of Forests,"[36]

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[35]Fraser, B., J. Baron and D. Ailman, *B.C.F.S./ Selkirk College Report on Public Involvement and Resource Use in Planning Units 4 and 5 -the Nelson Watershed*, (Castlegar, B.C.: Selkirk College, 1977), 3.
[36]Ibid.

and "public concern for the safety and continuity of the water supply is matched by Forest Service concern for the safety and continuity of the wood supply."[37]

There is very little data available with respect to water resources of the Nelson Watershed. The main source of data and information comes from the Water Rights Branch and from a report done by Dayton and Knight (January, 1973)[38] for the City of Nelson. Table 2.13 below shows a summary of the actual supply and demand for water by the city. The table does not include water user demands outside the city. With logging proposed for the Nelson Watershed, pressure from various groups to define and describe the water resource in the Watershed is increasing. At present C.D. Schultz, a consulting firm, is working towards this end along with the Water Rights Branch. However, budgetary and manpower limitations reduce the amount of field work the Branch is capable of undertaking or funding.

The main points to emphasize with respect to the water resource are: (1) the high dependence water users (urban and rural) have on flows from the sub-drainages of the Nelson Watershed; (2) the almost annual problem of water supply shortages during parts of the year and (3) the administrative and resource user (timber-water-amenity) conflicts.

2.8 Recreation Potential

Tables 2.14 and 2.15 indicate the generalized landform divisions and recreation suitability of landforms respectively in the Kootenay Lake T.S.A. The British Columbia Forest Service Recreation Planning Division situated in Nelson has developed a manual titled "An Inventory of the Wildland Recreation Resources of the Kootenay Lake Timber Supply Area"[39] in which supply summaries of recreation features and opportunities are presented. In the report a summary of recreation opportunities is presented which shows there are 90 identified potential recreation areas with a 138,979 carrying capacity estimate in recreation days per year.

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[37]Ibid.
[38]See p. 10 of the Selkirk College Report (1977).
[39]British Columbia Ministry of Forests, *An Inventory of the Wildland Recreation Resources of the Kootenay Lake Timber Supply Area,* Recreation Planning Division, Nelson Forest Region, (1979).

Table 2.13 Actual Water Supply and Demand for the City of Nelson

Water Source	Supply Mid-August (max. daily flow)	Current Demand Mid-August
Five-mile/Anderson/Fell Cr.'s	1.8 MGD*	3.6 MGD**
Selous Cr.	0.4 MGD	-
Apex Cr.	1.0 MGD	-
Clearwater Cr.	5.4 MGD	-
Total Available	8.6 MGD	-
Total Available (less Apex Cr.)	7.6 MGD	-

Source: Dayton and Knight (1973), in Fraser, et al, p. 10.
* MGD=Million Gallons per Day
** Total 1973 demand
Note: Current Total Supply (1973) = 2.2 MGD (Five-mile/Anderson/Fell plus Selous).
Current Deficit = 1.4 MGD (holdings in reservoir make up the deficit).

Table 2.14 Kootenay Lake T.S.A.-Generalized Landform Divisions

Name	Supply Blocks	Dominant Landform Features
Lardeau	A, B	High rugged peaks Steep, frost-formed aretes Major glaciers and icefields Glacio-morainal landscapes Narrow, steep sided valleys
Kootenay Lake	C, D and E*	Steep, rugged peaks Few remnant glaciers Evidence of ice sheet action rounded hills to 2 000 vertical meters
Creston	F, G, H, I and J	Few dominant peaks Low, rounded mountains and hills Broad valley bottoms Forest cover extends to mountain tops

Source: British Columbia Ministry of Forests, Kootenay Lake T.S.A. Recreation Inventory, p. 11.
* Supply Block E contains the Nelson Watershed

Table 2.15 Kootenay Lake T.S.A. General Recreation Suitabilitiy

Name	Supply Blocks	Dominant Landform Features
Lardeau	A, B	Best suited for extensive forms of recreation such as glacier travel and viewing, alpine hiking and dispersed camping
Kootenay Lake	C, D and E*	Best suited for moderately intensive forms of recreation such as fishing, sub-alpine and alpine hiking, dispersed and developed camping
Creston	F, G, H, I and J	Best suited for intensive forms of recreation such as developed camping

Source: Ibid.
* Supply Block E contains the Nelson Watershed

Finally, Table 2.16 below displays the generalized recreation opportunity breakdown in terms of total carrying capacity. The total capacity estimated was 454,864 recreation days per year or 137,838 parties per year, if the average party size is assumed to be 3.3 people.

2.9 Other Kootenay Lake T.S.A. Resources

The two resources which are of less importance in the Kootenay Lake T.S.A. are range for domestic animals and agriculture. In terms of agriculture, physical constraints limit the possibility of any widespread forms of agricultural production. Physical constraints to increased agricultural production are numerous, topography limits the area suitable for farming, soil depth and quality are inadequate and the climate tends to be highly varied depending upon altitude, slope, and aspect. Range is limited because of steep terrain and urban development of former grazing areas.

Table 2.16 Kootenay Lake T.S.A. Carrying Capacity Summary

Generalized Recreation Opportunity	Total Carrying Capacity Estimate*
All Trails	187 900
Popular Driving Routes	54 250
Snowmobile Areas	15 225
Forest Service Recreation Sites	58 510
Feature -Recreation Opportunity	138 979
Total	454 864

Source: Ibid., p. 192.
* Carrying capacity = Recreation Days per Year

2.10 Summary

The material presented above is quite detailed and may be confusing if not summarized in some manner. The main objective in providing such detail is to emphasize that there are a wide range of land uses in the N.F.R. and local study area. Often these uses are competitive in nature and can lead to considerable land use conflicts. To resolve these conflicts requires both public agency and interest group input. Of particular importance are the timber, water, recreation, and landscape resources of the area in terms of the net social benefits derived from their use.

3. Aspects of Economic Valuation, Institutions and Public Involvement

3.1 Introduction

The purpose of Chapter 3 is to present theoretical background material in a way that illustrates the relationship among existing institutional, valuation and public involvement theories and the study area issues. Chapter 3 has three main objectives: (1) a discussion of the economic problems related to the determination of land use trade-offs; (2) a description of the constraints on public agency planning, policy formulation, and decision making; and (3) a review of the public involvement process and its role in the Nelson Watershed land use conflict.

3.2 The Market System

The exchange of goods and services over a period of time can result in the development of clearly defined markets and prices. According to Sinden and Worrell (1979), economic theory postulates that "organized, competitive and large markets allow people to express and pool their comparative valuations of many goods and services." [40] On the other hand, Sinden and Worrell (1979) note, "most actual markets are not large and competitive and observed market prices and quantities must be used with care in estimating values," [41] and therefore, "market prices must be supplemented with supply and demand information before they can be used as value indicators for additional units," [42] of goods and services.

The accuracy and availability of supply and demand information is, to some extent, dependent upon the characteristics of the good or service under study. With extra-market goods and services, especially those produced in finite natural environments, accurate supply rather than demand information is more readily obtainable. The emphasis on supply is part of the main thrust of the study, i.e., to gather supply data for the important priced and non-priced resources produced in the Nelson Watershed and have individuals (stake holders in the issues)

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[40]Sinden, J.A. and A.C. Worrell, *Unpriced Values: Decisions Without Market Prices*, (Toronto: John Wiley and Sons, Inc., 1979), 43.
[41]Ibid.
[42]Ibid., p. 47.

suggest their own preferred land use alternatives. This goal may be achieved by developing a schedule that illustrates the trade-offs between a resource (timber) easily priced by the market and resources (amenity and water) that cannot be so priced. A process of this kind has the objective of allowing "people to express" ... "their comparative valuations",[43] in the absence of market prices. The main economic cause of the absence of price on extra-market goods is market failure.

3.3 Market Failure

If society has the single goal of maximizing aggregate individual utility and recognizes the amount of available resources as a constraint on choices, a competitive market would theoretically lead to an optimal allocation of scarce resources and production of goods and services.

Market failure,[44] and the consequent absence of market price, is a result of the characteristics of the water and amenity resources in that property rights affecting their use are inherently difficult to establish. Also, since they are produced on publicly owned land, the appropriability of these resources is reduced because of this institutional constraint. Sinden and Worrell (1979) refer to four causes of market failure: (1) "through external effects", (2) "through different recognition of the future", (3) "through lack of appropriability", and (4) "through secondary effects and the multiplier."[45]

The failure of the market system results in a price system that does not allocate scarce resources efficiently. Boadway (1979) feels this condition is important for two reasons,

> first it implies that market prices do not necessarily reflect marginal social benefits or costs and market profitability does not necessarily reflect net social benefits. Secondly, and more fundamentally, the failure of private markets to allocate resources efficiently provides an *a priori* reason for considering...government intervention in the

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[43]Ibid., p. 43.
[44]Defined in simple terms here as the failure or lack of a market to allocate resources in a Pareto-efficient manner; see Randall, A., "The Problem of Market Failure," *Natural Resources Journal*, 23 (1983), 131-148, for a discussion of the concept of market failure.
[45]Sinden and Worrell, p. 49-50, see also Bator, F. M., "The Anatomy of Market Failure," *Quarterly Journal of Economics*, 72 (1958), 51-79.

allocation of resources and/or in the pricing mechanism. [46]

However, Boadway (1979) also emphasizes that "the mere existence of market failure does not by itself justify public sector intervention." [47] The reader may refer to a paper by Wolf (1979)[48] for a discussion of this issue.

As discussed earlier, the land forming the Nelson Watershed contains a stock of economically accessible wood and the watershed produces extra-market goods in addition, i.e., amenity and water. When dealing with allocation of non-priced extra-market goods, neither the interest groups nor the public agency can begin to define, at the outset of the decision process, the socially optimal resource allocation. The development of a timber harvest infrastructure is assumed to have some unquantifiable yet negative effects on the level of expected benefits of water and amenity resources in the Nelson Watershed. This diseconomy or social cost would be external to the timber firm (B.C. Timber) and would be borne by the individual consumers of the water and amenity resources.

Among the causes of market failure two are described above, the first arises from the inappropriability of property rights and the second because of external costs. In both situations the outcome leads to failure of the market to allocate resources in an economically efficient manner. Without market prices individuals, interest groups, and public planners are unable to determine the true social value of the amenity and water resources produced in the Nelson Watershed and thus make correct decisions as to their optimal allocation. The equitable distribution of the benefits derived from the use of these resources is also important and is discussed later in the chapter.

Based upon the discussion of market failure above, more information on extra-market goods is necessary to adequately understand the nature of the amenity and water resources produced in the Nelson Watershed.

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[46]Boadway, R.W., *Public Sector Economics*, (Cambridge, Mass.: Winthrop Publishers, Inc., 1979), 30.
[47]Ibid.
[48]Wolf, C. Jr., "A Theory of Nonmarket Failure: Framework for Implementation Analysis," *The Journal of Law and Economics*, 22 (1979), 107-139.

3.4 Extra-market Goods

Samuelson (1954 and 1955)[49] and Musgrave (1959)[50] are two of the most significant contributors to the development of public goods theory. The definition of what constitutes a public good varies from Samuelsons' pure public good, e.g., air, to goods with less elements of publicness about them, e.g., outdoor recreation. The latter may be termed impure public or extra-market goods.

Inconsistent definition of public goods led Randall (1981) to identify four categories of goods and services according to the distiguishing characteristics of divisibility (rivalness) in consumption and exclusivity (appropriability) in use. The four types of goods or services are: (1) divisible, exclusive, (2) divisible, nonexclusive, (3) indivisible, exclusive, and (4) indivisible, nonexclusive .[51]

The existence of indivisibility of nonexclusivity results in a market pricing mechanism that operates inefficiently. According to Boadway (1979) if "a voluntary price mechanism cannot be enforced on rational individuals, any price charged for the use of nonexcludable public goods will have to be coercive, as with taxes. This failure of the voluntary pricing system due to nonexcludability is referred to as the free-rider problem." [52] Boadway (1979) goes on to state that for the same reason (free-rider) individuals and groups "will not be willing to reveal their marginal preferences for public goods voluntarily if they will be coercively priced or taxed accordingly,"[53] or conversely "there may be an incentive to overstate the benefits received." [54] As a result the planner or decision maker in public agencies and in general the individual or group lack sufficient information to deal with problems of determining prices and social preferences for different output levels of extra-market goods and services.

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[49]Samuelson, P.A., "Pure Theory of Public Expenditures," *Review of Economics and Statistics*, 36 (1954), 387-389; and "Diagramatic Exposition of a Theory of Public Expenditure," *Review of Economics and Statistics*, 37 (1955), 350-356.
[50]Musgrave, R.A., *The Theory of Public Finance*, (New York: McGraw-Hill, 1959).
[51]Randall, A., *Resource Economics: An Economic Approach to Natural Resource and Environmental Policy*, (Columbus, Ohio.: Grid Publishing Inc., 1981), 190-191.
[52]Boadway, p. 31.
[53]Ibid., p. 32.
[54]Ibid.

Returning to the problem of how best to maximize the social net benefits produced by publicly owned forest land, it is important to identify and discuss the efficiency and equity criteria as they relate to the problem of the use of the timber, water and amenity resources of the Nelson Watershed.

3.5 Criterion for Natural and Environmental Resource Use

Notwithstanding the nature and conditions for market failure and the existence of extra-market goods, two criteria are important to judge resource allocation alternatives. They are efficiency and equity.

3.5.1 Efficiency

A project can be termed efficient, and therefore desirable, if the benefits exceed the costs. The criterion of efficiency in the context of the study always relates to that of Pareto-efficiency. The three conditions necessary for Pareto-efficiency according to Randall (1981) are:

1. Efficient Resource Allocation - "The rate of technical substitution of any pair of inputs should be equal for all firms in the production of all commodities that use those inputs, and should be equal to the ratio of the prices of the inputs." [55]
2. Efficiency in Consumption - "the rate of commodity substitution for any two commodities should be equal for each consumer and equal to the ratio of commodity prices."[56]
3. Efficient Product Mix - "the rate of product transformation of any two commodities should be equal for every producing firm and should be equal to the ratio of commodity prices."[57]
4. Summary Condition - "the rate of commodity substitution for any two goods should be equal for all consumers and it should be equal to the rate of product transformation for

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[55]Randall, p. 118.
[56]Ibid.
[57]Ibid.

the same two commodities for all firms and both should be equal to the ratio of commodity prices."[51]

The sufficient condition for Pareto-efficiency is that all isoquants and indifference curves must be non-concave.[59]

The conditions described above for Pareto-efficiency in resource allocation describe efficiency in the static sense. A more important consideration is the attainment of intertemporal Pareto-efficiency. Time is an important factor in the use of resources and must be considered to be able to develop resource use decisions that are Pareto-efficient. Howe (1979) defines intertemporal Pareto-efficiency in the following way, "a policy or a pattern of resource use over time is said to be Pareto-efficient if and only if it is not possible to increase the utility of the affected parties at any point in time without decreasing utilities at other points in time."[60]

The identification of Pareto-efficient points requires prices or values (see Conditions 1 to 4), without them the efficient allocation of extra market goods is difficult to attain. The proposal to develop the timber resource of the Nelson Watershed has market failure problems associated with it: (1) as a result of the nature of the property rights of the Nelson Watershed and (2) as a result of potential externalities that may arise from the implementation of the timber harvest plan. There is no means of ensuring that the timber harvest plan is optimally Pareto-efficient without placing values on the extra-market goods.

3.5.2 Equity and the Social Welfare Criterion

The social welfare function is used to express the preference of a society for a particular distribution of benefits from the use of resources. The key problem in determining the social welfare function is the difficulty in deriving a consensus as to what the proper distribution of the benefits in a society should be. The determination of a consensus is made

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[58]Ibid.
[59]Ibid.
[60]Howe, C.W., *Natural Resource Economics: Issues, Analysis and Policy*, (Toronto: John Wiley and Sons, 1979), 151.

more complex when extra-market goods, which are valued differently by different individuals and generally cannot be priced, are considered along with the distribution problem.

Moving again to the Nelson Watershed land use conflict, the development of a consensus that describes the most equitable distribution of the benefits of the watersheds resources (timber, amenity and water) is also difficult to achieve. All of the groups and individuals involved in the conflict have different land use preferences based on their valuation of the different resources. Individuals in interest groups might perceive the benefits of harvesting timber to be lower relative to water and amenity resources benefits, individuals in the firm or public agencies *vice versa*. Because of the insurmountable theoretical problems with identifying an optimum distribution, much of the social welfare question lies outside the realm of economics. The contribution of economics is to identify the distribution of benefits. Any public input process could contribute to the establishment of weights for determining the distribution of benefits by providing some idea of the local social consensus to public agencies.

3.6 Valuation Methods

Four theoretical approaches have been developed to deal with the problem of valuing and conserving environmental intangibles such as the water and amenity resources of the Nelson Watershed. The four approaches are listed below:

1. The Critical Value Approach
2. The Dominance Approach
3. The Safe Minimum Standard Approach and
4. The Sensitivity Analysis Approach[61]

The idea of opportunity cost is related to the critical value approach and both are used in the study to address the extra-market good valuation problem mentioned earlier. The critical value approach is discussed below.

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[61]See Phillips, W.E. and D. DePape, *The Role of Economics in Shorelands Evaluation*, I.M.P.A.C.T. Environomics for Environmental Coordination Services Alberta Environment (1976), 34-47.

Sinden and Worrell (1979) give a comprehensive discussion and summary of a number of methods to value and analyse extra-market goods and services. A review of these methods suggests that opportunity cost is appropriate to use in the determination of amenity and water values and in defining public and private sector behaviour towards planning for these resources in the study area. Lipsey, Sparks and Steiner (1976) define opportunity cost as "the cost of using resources for a certain purpose, measured by the benefit or revenues given up by not using them in their best alternative use."[62] Put more concisely, the benefit of an unconsumed good or service is reflected in the cost of an alternative that is actually purchased. On the basis of these simple definitions an *a priori* relationship may be postulated between opportunity costs of foregone timber revenues and the benefits of amenity and water resources of the Nelson Watershed. Carroll (1978) clearly discusses the *a priori* nature for this relationship.

> In competitive markets, long-run equilibrium output achieves a level at which long-run average unit costs of production are equal to price. Consequently there is some justification for assuming that marginal amenity benefits are equal to opportunity cost, but only if long-run equilibrium amenity outputs and inputs occur in competitive markets. In practice there is little evidence that this assumption can be justified. As an alternative approach one may assume that an individual woodland manager will not allocate resources to amenity beyond the point at which the benefits are at least equal to the costs. Thus, opportunity cost, under this assumption, is equal to or less than, amenity benefit.[63]

Considering the discussion above, a minimum value of the amenity and water resources produced in the Nelson Watershed is reflected in the acceptance of reduced net present value resulting from forgone timber production in the watershed. The opportunity cost of foregone timber revenues accepted by different groups (e.g. interest groups, firm and public agencies) is assumed to be equal to the minimum level of benefits of amenity and water that is perceived by these groups. The opportunity cost accepted by interest groups in the study area may be quite different from that of public agency and firm personnel. Identifying the valuations of amenity and water may assist in the determination of a trade-off between these resources and timber in the watershed This identification process may then assist public agencies in making decisions

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[62]Lipsey, R.G., G.R. Sparks and P.O. Steiner, *Economics*, 2nd ed., (New York: Harper and Row, 1976), 913.

[63]Carroll, M.R., *The Multiple Use of Woodlands*, Occasional Paper No. 10 (Cambridge: University of Cambridge Department of Land Economy, 1978), 47.

which move closer to maximizing social net benefit than if the valuations were not considered at all.

How does opportunity cost relate to the critical value approach? All of the approaches mentioned earlier are useful as analytical tools in the processes of policy formulation, planning and decision making, by providing information on alternative uses of public land and resources. Explicitly defining the trade-offs between intangibles and more readily quantifiable resources directly contributes to the consideration of the intangibles in the processes mentioned above. The approach that is most useful in resolving the study area problem is critical value. The critical value concept was developed (Krutilla and Cicchetti, 1972) and expanded (Krutilla and Fisher, 1975) mainly by J.V. Krutilla. The critical value approach is useful only when intangibles exist in one of two use alternatives. In the study area the two use patterns are: (1) timber harvest or (2) amenity and water. The assumption made is that use pattern 1 does not have any intangibles and that use pattern 2 consists only of intangibles. The net present value of the timber harvest alternative is assumed to be the critical value of the development option. Since the first alternative has no intangibles the tangible net benefit of the timber harvest alternative is equal to its social net benefit. The situation can be described as follows:

(1) InB_2 greater than 0 and $InB_1 = 0$

(2) Critical Value of Alternative 1 is SNB_1

(3) $SNB_1 = TaNB_1$ since $InB_1 = 0$

(4) $TaNB_2$ is less than critical value therefore,

(5) a value judgement of the level of InB_2 is needed.

Definitions: a) InB_1 = Intangible Net Benefits Alt. 1

b) SNB_1 = Social Net Benefit Alt. 1

c) $TaNB_2$ = Tangible Net Benefits Alt. 2

After establishing the critical value of the different land use alternatives described in the next chapter, the individuals involved in the interview procedure are allowed to determine what in their judgement is the value of the intangible net benefits of alternative 2. This value is determined indirectly using opportunity cost. If the individual or group feels that the intangible benefits of the second alternative are greater than the critical value then the water/amenity use pattern has the highest social net benefit. The reverse is true for an individual who feels that the intangible benefits of alternative 2 are less than the critical value.[44]

In conclusion, the opportunity cost approach provides information for decisions (planning, policy formulation, and decision making) by deriving a monetary estimate of social benefit subject to costs for a range of supply alternatives of unpriced resources. This valuation can be eschewed by using a number of variants of the opportunity cost method (see Figures 3.1 and 3.2). The approaches aid in the derivation of a minimum value for extra-market goods by assuming social net benefit is the loss in money income (marginal social cost) from other priced resources like timber. A decision is then possible if the decision maker has some estimate of the value of the alternative, e.g., standing timber.

The advantages and of the opportunity cost approach may be summarized as follows:

a. methods provide information for planning by deriving a shadow price or monetary estimate of social net benefit for a range of supply alternatives of extra-market goods.
b. a minimum value for extra-market goods may be derived by assuming social net benefit is the loss in revenue (marginal social cost) from other priced resources.
c. decisions that can more easily achieve maximization of the benefits of priced and unpriced goods produced on publicly owned land are possible if the estimates of both types of goods are available.

The disadvantages may be summarized as follows:

a. the methods measure the costs of obtaining products, services or access associated with unpriced things; they do not measure the utility of the unpriced good or service, thus,

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[44]Phillips and DePape, pp. 40-42.

they ignore the basic rationale of valuation.

b. the methods implement the proposition that benefits must be at least equal to the costs incurred; they therefore provide only minimum estimates of the benefits derived from the use of unpriced goods.

c. methods that make simple interpretations of value wrongly imply that higher (lower) costs always mean higher (lower) benefits.

The criticisms above must be accepted for valuation in the strictest sense, but they may not be valid at all if the objective is in making resource allocation decisions rather than directly valuing the benefits of extra-market goods.

3.7 Forest Resource Trade-offs

The forest woodland manager is faced with the task of managing the outputs and producing optimum net benefits from forest land. Because of the large array of possible products (tangible and intangible) the task is a complex one. Multiple-use is defined as the planned development of forest land on which several uses are carried out at the same time. This is a narrow definition of multiple-use and is expanded upon below. There are four trade off relationships between any two products (A and B) of forested land. These relationships are determined by the nature of the physical interrelationship between the two products. The four interrelationships can be: (1) Complementary -where the output of product A increases as the output of product B increases over a certain range; (2) Competing -where there is a direct trade-off between products A and B; (3) Supplementary -where there is no interrelation between products A and B; and (4) Conflicting -where the production of product A has a negative effect on the output of product B.

The interrelationship between the timber resource (when harvested, etc.) and amenity produced in the Nelson Watershed is assumed in this study to be conflicting. Active timber harvest and road construction in the watershed would reduce the benefits that could be derived from amenity. The degree and extent of loss of amenity benefits is as yet unquantifiable.

Method	Policy Information That Can Be Derived
	The Effect of
1. (a) Estimate a supply curve from production costs	A range of potential benefit values on optimal quantities of output
(b) Adjust by costs of providing same benefits	Replacing or maintaining environment or income
	Income Foregone by
2. Net income foregone	Adopting a project that is suboptimal
3. Marginal revenue product	Changing resource level by one unit
4. Costing constraints	Restricting a priced activity to a non-optimal quantity
	Identifies the Alternative
5. Cost minimization	that provides a given benefit at least cost

Figure 3.1 Opportunity Cost Methods

Objective	Methods
1. To estimate impact on business activity	Consumers' expenditure, producers' expenditure, value added
2. (a) To estimate consumers' surplus	Cost savings, Milliman's range
(b) To estimate total benefit	Marginal revenue product, Milliman's range, cost savings
3. To select the least-cost way of achieving a given goal or benefit	Cost minimization procedure, costing constraints, marginal revenue product

Source: Sinden and Worrel, 1979, pp. 274-275.

Figure 3.2 The Role of Opportunity Cost Methods

B.C.F.S. personnel feel that the loss for north shore residents would be minimal based on preliminary studies. The interrelationship between timber harvest and road construction and water quality and quantity is more complex. If the quality and quantity of water is reduced as a result of forest industry activity in the watershed, then the interrelationship is necessarily conflicting. However, if the application of specialized harvesting methods increases the quantity of water available while maintaining the quality, then the interrelationship may be complementary. The author concluded that the latter interrelationship is unlikely in the Nelson Watershed for the following reasons. The volume flow of water is quite sufficient early in the year where the quantity increasing effect of small cutblocks would be most beneficial. The period of time (late summer) after spring run-off is most critical since it is the period where the effects of the small cutblocks would have the least impact on increasing the quantity of water available. Storage of water during the spring run-off would be necessary to enhance the benefits of small cutblocks or selective cuts. This storage capacity does not presently exist in the Nelson Watershed area although, a small reservoir is used to store a limited amount water for use late in the summer by residents of the City of Nelson. The effect on quantity of water produced in the springs and wells of surrounding rural residents is more difficult to determine. The author concluded that road construction would have a negative effect on the production of subsurface water. Small cutblocks and selective cuts would have a negligible effect on the quantity of water produced.

The most important effect on the water resource resulting from harvesting and road construction activity is in terms of quality. If this activity contributes to an increase in the sediment load carried by the creeks in the watershed, measures would be necessary to clean the water or find an alternate source. For the City of Nelson either one of these measures would be costly. Estimates for a water treatment plant range from seven to ten million dollars.[63] The effect of sediment and other debris in the creeks may also have an effect on the Kokanee salmon spawning in the lower reaches of Five-Mile and Lasca Creeks. Resident trout

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[63]Discussions with representatives of the City of Nelson.

populations may also be reduced. Road construction may also have a serious effect on the quality of water received by rural residents living below the proposed main haul roads.

To summarize, the effect of timber harvest and road construction activity of an ongoing nature with water is assumed to be conflicting although the degree and extent is presently not quantifiable.

There are three major strategies for multiple-use forest management: (1) Spatial -separating the uses but maximizing product benefits over a larger land unit; (2) Concurrent -combining uses on each hectare of land (the multiple-use definition described above); and (3) Temporal -varying the mix of uses over time. For the purpose of this study the strategy of multiple-use forest management in terms of the Nelson Watershed is considered from spatial and temporal viewpoints. The spatial strategy involves the allocation of watershed area for timber production while the remainder is withdrawn to preserve or conserve existing amenity and water benefits (see Scenarios 1, 2, 3 and 4, Chapter 4). The temporal strategy is incorporated by delaying implementation of the proposed harvest plan for a period of five years (see Scenarios 2 and 4, Chapter 4) and maintaining the watershed in its present condition.

3.8 Public Agencies

Public agencies involved with resources were established to control their use. This might be necessary to place unowned land in the public sphere, or to limit the apparent depletion of the resources. The publicly owned forest land in the Nelson Forest Region is an example of a resource under agency control. The B.C.F.S. manages this land to conserve the timber resource for the benefit of present and future generations (refer to policy in Chapter 1).

Numerous studies have been conducted that analyse the structure, function and performance of public agencies in terms of their policy, planning and decision making abilities when influenced by internal and external forces. In *Inside Bureaucracy* Anthony Downs (1967) discusses plausible hypotheses concerning bureaucracies and summarizes them in his final chapter. He also develops three central hypotheses and sixteen laws concerning bureaucratic

organizations; these are summarized in Table B.1 in Appendix B.

Other authors[66] have attempted to show that many public agencies that have mandates to manage publicly owned land often have difficulty making decisions or developing plans and policies which are efficient and equitable, especially if they have a mandate to manage resources that have a large extra-market good element. The reasons for such difficulties are conveniently classified as internal and external limitations.

3.8.1 Internal Limitations

According to Baden and Stroup (1977) a

> bureaucracy is defined as an organization that : (1) receives at least part of its budget from grants rather than exclusively from the sale of packageable goods; and (2) has managers who neither receive a portion of its profits as personal income nor personally absorb any of its losses. From the standpoint of public welfare, these features create the possibility of a pathological institution, that is, one that does not serve its supposed purpose.[67]

Because nonpriced products occasionally dominate the managerial concerns of most public agencies difficulties arise during these periods for managers to estimate the relative value of the nonpriced goods (e.g., amenity and water) as opposed to priced goods (e.g., timber). As a result identification of the economically optimal allocation of resources by the public administrator is severely constrained. Thus, the use of economic efficiency in achieving the overall goal, or mandate, is limited.

A recognised feature (see Downs (1967)) of bureaucracy which can result in organizational problems is to continually increase the size and scope of the public agency with the objective of increasing its budget and power. The size increasing condition does not appear to be a significant problem in the conflict surrounding the use of the Nelson Watershed.

Another internal limitation is goal setting which relates only to internal objectives of the

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[66]See Ostrom, V. and E. Ostrom, *A Theory for Institutional Analysis of Common Pool Problems*; E. Ostrom, *Collective Action and the Tragedy of the Commons*; R.L. Bish, *Environmental Resource Management: Public or Private?*; and Baden, J. and R. Stroup, *Property Rights, Environmental Quality and Management of National Forests*; all in Hardin, G. and J. Baden (ed.'s), *Managing the Commons*, (San Francisco: W.H. Freeman and Company, 1977), various pages.

[67]Baden and Stroup in Hardin and Baden, p. 232.

agency. Finally, a public agency may be established to manage only a narrow set of resources. This constraint may limit the ability of the agency to determine and incorporate other fields into its own planning, forcing it to be highly dependent upon other, sometimes competitive, agencies for information. Specialization could also result in the public agency assigning low priority to some of the impact of its decisions in areas where it does not have jurisdiction.

3.8.2 External Limitations

The external factors which may determine public agency policies and plans are: (1) politically oriented, (2) pressure by private and public sectors, (3) related to public agency jurisdictions and cooperation, and (4) related to the problem of valuing extra-market goods. An example of pressure by lobbying in the Nelson area can be seen in the activity of the three interest groups in the Nelson Watershed land use conflict, The City of Nelson, the M.S.W.U. and N.A.W.C. All three have a special interest in influencing or stopping the implementation of the land use plan as proposed by the B.C.F.S. Indirect pressure through the media and directly to public agency personnel has slowed the implementation of the land use plan and may alter its content in the long-run. On the other hand both B.C. Timber and the B.C.F.S. feel the wood of the south shore of Kootenay Lake is important to develop for production and management reasons.

There is an ongoing debate among economists, public administrators and politicians over the best delineation of agency responsibilities, i.e., the jurisdictional boundary. Some of the problems in the Nelson Watershed area stem from jurisdictional conflicts between the B.C.F.S. and other public agencies. Because agencies have such narrow jurisdictional boundaries which delineate the areas of responsibility or have boundaries which are arbitrarily fixed, interagency cooperation may become a problem. "Probably no factor contributes more to hindering cooperation between resource agencies than their undeclared competition for the scarce resources of land and money"[61] suggests R. Ogle (1972) in a paper dealing directly with

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[61]Ogle, R.A., "Institutional Factors to Encourage Interagency Cooperation in the Management of Natural Resources," *Public Administration Review*, 32 (1972), 19.

alleviating the cooperation problem. Presently new strategies in the Kootenay Lake T.S.A. that encourage interagency cooperation are being utilized to cope with increasingly complex problems of managing publicly owned land and resources.

There are a number of public agencies and auxiliary branches within these agencies in the British Columbia government hierarchy (see Appendix B). The federal agencies that are involved are listed also (see Appendix B). No order of size or importance of the organizations is intended in the tables. Because of the complexity and number of issues, programs, and objectives of the provincial and federal agencies listed in Appendix B, there is no attempt to discuss them here. Refer to the Ministry of Forests, *Forest and Range Resources Analysis Technical Report*, (1980) for a summary.

3.9 Policy Formation and Decision Making in British Columbia

M.R. Carroll (1982) "Conservation Values" [69] and especially Section 5.4 "Aneconomic Development in British Columbia" describes the policy formation and decision making processes. According to Carroll,

> the public agency decision making apparatus typically has a minister trying to impose political solutions from the top down, a bureaucratic block of civil servants who push for the aggrandisement of the resource values for which they have responsibility, and a highly selective information screen at all levels which permits only certain information into or out of the agency. Decisions are sometimes 'coordinated' through systems which attempt to improve communication between agencies. [70]

Carroll also suggests that in B.C. the

> decision making process fits into the following system: (1) resource agencies have regions in which certain decisions are made, the decision making power at the regional as opposed to provincial level varying with each agency; (2) regional districts are established under the Ministry of Municipal Affairs, which to a limited extent only plans the development of settlements, but which mainly *responds* to pressure rather than creating a strategy Technical Planning Committee to give *advice* only; (3) at the provincial level, the Environment and Land Use Committee (E.L.U.C.), which is a subcommittee of cabinet ministers, establishes policy which transcends single resources, and also makes decisions on certain contentious projects; and (4) regional Resource Management Committees are advisory inter-agency committees which supposedly consider projects, problems and policies which transcend single resource

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[69] Carroll, M.R., "Conservation Values", Unpublished Manuscript, (Edmonton, Alta.: University of Alberta, Department of Rural Economy, 1982).
[70] Ibid., p. 296.

agencies. However, their real power is minimal, and the political will to cooperate between ministers is lacking."[71]

In spite of the limiting factors suggested above the B.C.F.S. has considerably improved its integrated management of forested land. A new Forest Act (1978) was developed which created a ten year resource analysis and five year planning program. This structure is innovative and integrative because it allows for the review of goals and achievement of these same goals developed in programs.

3.10 Public Participation

3.10.1 Introduction

In Canada there have been rapid changes in the role of the public in decisions relating mainly to environmental management, especially in the last 15 to 20 years. These changes have generally taken the form of new legislation and institutions encouraging greater public participation in one or all of resources planning, decision and policy making.

In the study area the purpose of public involvement is to determine attitudes of the local citizens' groups towards land use in the Nelson Watershed (see Figure 3.3). The British Columbia Forest Service has been given a mandate to increase the degree of public involvement in the management of publicly owned resources. The approach actually used is described below.

3.10.2 The Process of Public Involvement and Land Use Planning Over the Nelson Watershed

Figure 3.3 and the subsequent description give an overview of a typical process of public involvement and land use planning and then tie in the process as it occurred in the Nelson Watershed. A certain amount of caution should be used because the figure shows a simplified version of a very complex process. Nevertheless, it does attempt to highlight the more salient features of the process.

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[71]Ibid., pp. 298-299.

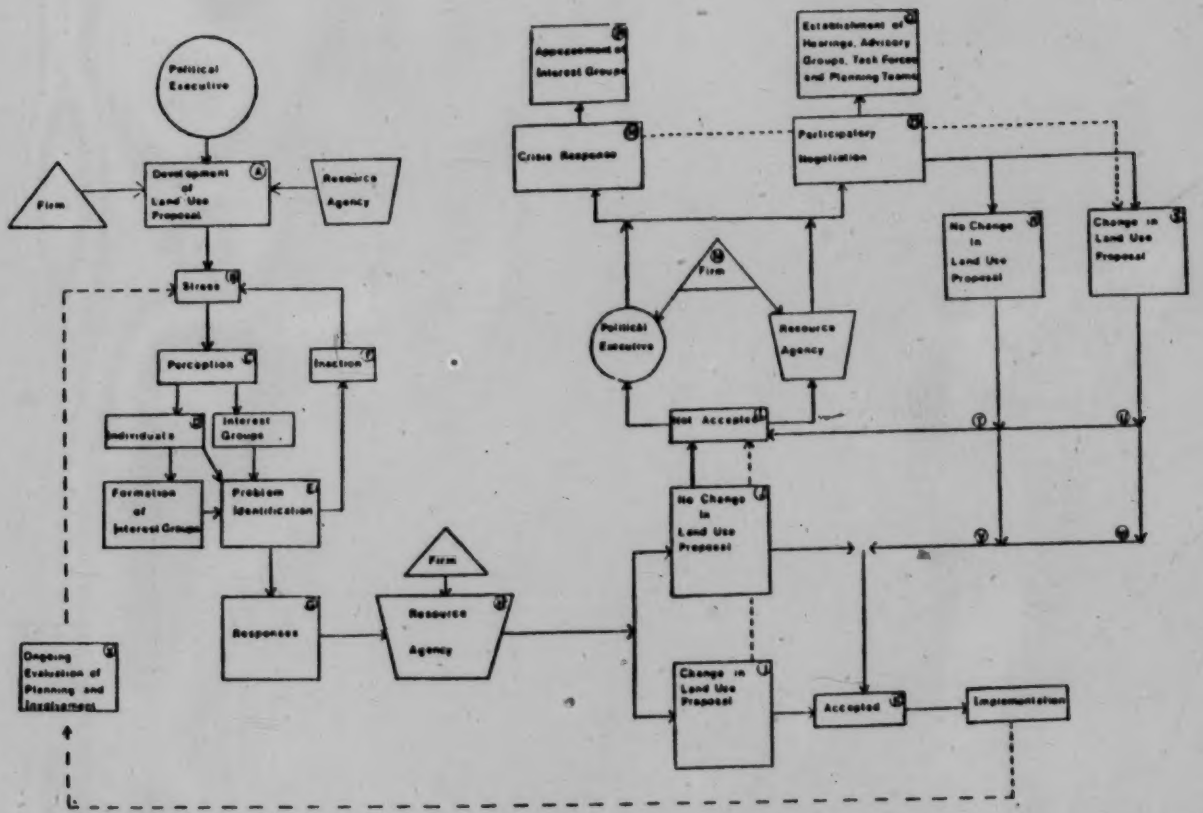

Figure 3.3 A Public Land Use Planning and Decision Making Process in British Columbia: the Nelson Watershed Example

3.10.3 Flow Diagram Description

Figure 3.3 illustrates, systematically, the evolution of land use proposals, policies and decisions emanating from political, private and public sector involvement in that process. At point A a number of critical factors have contributed towards the development of a policy or plan to use the timber resource of a relatively undisturbed watershed, in this example the Nelson Watershed. The factors are a dwindling supply of economically accessible timber, which is compounded by declining demand for wood products and a need to manage, i.e., protect the productive forest from disease, fire and insects, on a more intensive level to protect present and future wood supplies. Other less critical factors were mentioned earlier in the study.

The development of a proposal to use the Nelson watershed timber resource had two major contributors and a minor one. The former were the Ministry of Forests, specifically at the local (T.S.A.) and regional levels and provincially owned British Columbia Timber (Kootenay Forest Products Division). The latter contributor was associated with the political executive of the British Columbia cabinet. Involvement of these three parties is quite typical of the development of land use policies and proposals dealing with Crown owned timber dispositions. B.C. Timber presently holds the rights to harvest the timber in the Nelson Watershed which is managed by the Ministry of Forests and political agreement to this end is necessary for harvesting to proceed. The extent of political influence in the development process could not be determined and therefore, must be viewed with some caution.

The policy or land use proposal first developed by the three parties was then communicated to the general public and interest groups. This was achieved indirectly through the press and directly through Ministry of Forests personnel to key individuals or groups that were affected by the proposal or that had a stake in the issues arising from the plan.

The development of a policy or plan to use the resources of relatively undeveloped land may not create significant problems if the area to be disturbed is geographically remote. Nevertheless, this is not the situation with regard to the Nelson Watershed, i.e., it is relatively undisturbed but is immediately adjacent to an urban area. Therefore, the policy or land use

proposal once communicated would be expected to trigger a variety of reactions. Points B and C illustrate this perception process. From this stage onward some of the most affected or interested individuals may form interest groups to deal with the stress they now perceive. The evolution (point D) may not occur at this stage in the conflict if the information communicated is inadequate or the implications of the plan are not immediately obvious to members of the public or interest groups. This kind of situation arose over the Nelson Watershed. Only a loose grouping of individuals from areas adjacent to the city and some from within the city formed at an early stage in the conflict. Interest groups existing at the time that expressed initial concern were S.P.E.C. and the City of Nelson (city council).

In any case there was an immediate demand for more detailed information on the land use plan from individuals and interest groups. The process is described at point E, where the transition occurs from an initial, and occasionally uncommmunicated, emotional, uninformed and uneducated response to the proposal, to a more rational and logical definition of the major issues. Once the transition is more or less complete, individual and interest group responses (point G), which the public agency and firm expect and usually try to elicit, are then transmitted to the agencies and firms involved.

The major problems, voiced by the city council, city and rural residents, that stemmed from the land use proposal were: (1) a fear, of the negative alterations in water quality and quantity and the consequent socioeconomic and environmental costs, (2) the potential reduction or destruction of the aesthetic quality of the watershed and (3) the loss of extensive recreation potential in the watershed. The responses that were communicated based upon these concerns ranged from outright refusal to accept any harvesting activity, to partial acceptance (with reservations) of the proposed harvesting plan, to full agreement with the plan.

There was another possible result of the problem identification stage described at point F, inaction. Normally this event would be rather unusual at the outset of a conflict, but after a period of escalating conflict the pressure on the decision makers may be sufficient enough to suppress all public discussion pertaining to the conflict. A situation such as described above has

not as yet arisen to any significant extent over the Nelson Watershed even though conflict escalated over alternative dominant forms and extents of land use patterns. Inaction did not occur much to the credit of Ministry of Forests personnel who stuck to their mandate for public involvement.

Formal and informal responses to the Nelson Watershed land use proposal were then channeled back to the Ministry of Forests and subsequently to B.C. Timber. The Ministry of Forests then had three options open to it (point H): (1) to disreguard the responses except those favourable to their proposal, and continue as before (point F), (2) to respond to the public input but with no significant change in the policy or plan (point J) or (3) to significatly alter the policy or plan to appease public interests (point I). The form the response takes is influenced by a number of factors such as the economic urgency for development. However, the major influence comes from the firm, in this case B.C. Timber and from the political constraints the Ministry of Forests personnel must operate under.

In the Nelson Watershed case the Ministry of Forests expressed a willingness to change its plans but would not do so immediately. This response was perceived by concerned individuals and groups as a stalling tactic and that a final decision to implement the plan set out in the development proposal had already been made. An adversary situation resulted and communication between the two sides broke down. Two avenues of response were open to the groups and individuals as a result of the Ministry of Forests stance. The first, to reject it outright (point L) or second to accept it (point K). The development of the adversary or conflict conditions caused rejection of the Ministry proposal. A more concrete and socially acceptable land use proposal was needed by the Ministry of Forests at this point but was not visibly forthcoming.

If the change in the proposal, or possibility thereof, had been accepted (point K), then, at some stage the plan would have been implemented and evaluated in an ongoing manner (point X). Subsequently, some form of stress may be created (e.g., by inadequate road construction or harvesting operations) which would initiate some part of the process again

(points B to J).

Nevertheless, the initial plan was rejected. The Ministry of Forests, specifically at the local level, had two options open to it at this point: (1) to consider the situation as unresolvable and, if the conflict were serious enough (point N), to involve the political executive (point M) to placate (point P) the parties involved or (2) to initiate the establishment of some form of participatory involvement by those involved (point O). The firm(s) involved would play a reduced role in determining, by its need for timber, its financial situation and economic and political power, the form and content of the reponse (point M).

The Ministry of Forests then sponsored the development of formal interest groups concerned with the use of the Nelson Watershed, namely the two groups, M.S.W.U. and N.A.W.C., as mentioned previously. Small scale public hearings were initiated so that interested individuals and groups could voice their concerns on a one on one basis with Ministry of Forests personnel and industry spokespersons, the public hearing stage of the public involvement process (point Q).

Public involvement activity continued. This amounted to the education of all parties (public agency personnel, interest groups and the general public) in terms of one anothers concerns. However, the consultation did not result in any compromise and thus no change in the land use proposal for the watershed developed (point R). The situation was again seen as unacceptable (point T) to those concerned groups and individuals. Therefore, any acceptance and implementation of the plan to use the watershed timber was effectively blocked by them.

The main effect of the deadlock was to force the Ministry of Forests to take further steps to resolve the impasse. Three choices were obvious: (1) take the route of inaction, (2) accept a crisis response or (3) increase the degree of public participation specifically with interest groups and other public agencies with the formation of an advisory group (point Q).

The Ministry of Forests chose the third option but stipulated that the role of interest groups and firm (which had greater direct access to the B.C.F.S.) would be strictly consultative in nature, with no direct decision or policy making powers. This followed the mandate set out

that all decision and policy making authority would remain with the Ministry of Forests. Therefore, room existed for some form of public input but no real public output, i.e., seeing interest group concerns actually altering the watershed land use proposal.

At this stage it became apparent that the Ministry of Forests had excluded those groups and individuals, not represented by an accepted group, from the consultative process. The main negotiators remaining were the N.A.W.C., the City of Nelson, M.S.W.U., Ministry of Forests, B.C. Timber, and Water Rights Branch. Members of interest groups sitting on the committee expressed their concern that the Ministry of Forests and B.C. Timber were cooperating privately to undermine any real acceptance of the majority of the concerns expressed by the groups, and that the participatory process was merely 'window dressing'. Again the land use proposal was found unacceptable.

The Ministry of Forests was for the second time faced with a choice between the three options mentioned earlier. To its credit the Ministry (as late as May or June, 1982) again chose to increase the role of the public and concerned public agencies (point Q). The result was the establishment of a planning team which included those members present at the end of the consultative process. Further stipulations were added by the Ministry of Forests personnel. The terms of reference were:

1. Only those representatives of interest groups with a legal claim, i.e., a water licence, would be permitted on the planning team. The main purpose being to limit external interference, garner greater responsibility from the representatives when planning and to create a feeling of commitment in them for the whole process; and
2. Final decision and policy making would remain with the Ministry of Forests even though the agency would remain generally neutral in the planning team meetings.[72]

The material above describes the situation during the spring and summer of 1982. Initiation and communication of the project occurred in the early to middle part of 1979. Additional members for the planning team, i.e., the Ministry of Mines and Petroleum

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[72]Discussions with Ministry of Forests personnel.

Resources and the Selkirk Health Unit, were actively being sought. In early 1983 plans to sell the mill in Nelson were announced by B.C. Timber. The plans also included the transfer of the watershed timber rights to the B.C. Timber integrated complex at Castlegar. Reasons for the proposed sale were mill inefficiency and depressed forest products markets. No further developments have arisen that have a bearing on resource use in the Nelson Watershed. Thus, approximately three years have passed since the land use proposal for the Nelson Watershed was communicated.

3.10.4 The Limits to Public Involvement

The process of public involvement such as the one described above has inherent difficulties. Defining efficiency of the public involvement process depends upon identifying a specific objective of the process. There is no real consensus about what this objective is intended to be. This study assumes that placing values on intangibles and identifying the distribution of benefits is an important part of the process.

The connotations inherent in terms like public involvement or participation are highly variable which, as Wengert (1976) points out, result in a situation where "neither normative nor empirical theories applicable to the topic have been formulated". [73] Also, much of the content of the increased literary activity in the 1960's and 1970's dealing with public involvement has paid little heed to other earlier political ideas, and analyses and to empirical research in the field of sociology.[74]

In the context of the democratic process public participation is an opportunity for public agencies to gain additional specific information on public attitudes beyond that provided in voting for political parties. It is also a mechanism for minorities impacted by a specific proposal to provide input so that public agencies can weigh this with regard to the agency mandate and social responsibilities.

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[73]Wengert, N., "Citizen Participation: Practice in Search of a Theory," *Natural Resources Journal*, 16 (1976), 23.
[74]Ibid., p. 24.

Perhaps the greatest obstacle to developing a well defined public participation theory is concerned with determining how people or groups perceive the whole process of participation. Perceptions are closely tied to motivation, which is generally individualistic in origin but can also be associated with group motivation. Because motivations are relatively complex, the behaviour of individuals and groups (to a lesser extent) stemming directly from motivation is difficult to predict. As Wengert (1976) states "in most situations, the best explanations must rely on the weakest component of scientific method, inferences, and circumstantial evidence".[75]

Wengert (1976) also discusses five roles for participation in terms of how it is perceived. They are: "(1) participation as policy, (2) participation as strategy, (3) participation as communication, (4) participation as conflict resolution, and (5) participation as social therapy".[76] Since participation can fulfill quite different roles, its particular application will obviously depend upon the chosen role in any case. In the B.C.F.S. the stated role is essentially communication.[77] In the Nelson Watershed the regional B.C.F.S. action has lead to the use of participation as conflict resolution as included in Figure 3.3. To develop programs of public involvement and have them accepted by and incorporated into established institutions, requires a legal basis. The legal basis for public involvement is discussed in the following section.

3.10.5 The Legal Basis for Public Participation

There have been a number of investigations (see Morley (1975) and Lucas (1976), among others), to determine if legal grounds existed in Canadian common law for public participation. The most common answer was that there were no grounds, except for a few cases of legislation that described some ambiguous form of public involvement (e.g., B.C. Ministry

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[75]Ibid., p. 25.
[76]Ibid., pp. 25-27.
[77]Apsey, F.W., "Resource Management in British Columbia," in Integrated Management of Resources, Proceedings of a conference Nov. 2-4, 1978, Vancouver, Resources Industries Programmes Centre for Continuing Education, University of British Columbia.

of Forests Act 1978, Section 4(c)). Morley (1975) listed in his executive summary the results of his research into the legal aspects of public participation. His findings are as follows:

> (1) the Canadian legal system (comprised of federal, and provincial statutes as well as common law) does not guarantee the citizen a right to participate in public and private decisions concerning resource development and management; (2) in the Canadian legal system, the common law allows the citizen to be heard by the decision making apparatus which affects him, and allows him to make claims for compensation; (3) in allowing this, the legal system is reactive since the plaintiff must prove damage. Legal redress can only occur after the fact. As a result, this limited recourse has not proved to be an effective tool for participation; (4) where the public is marginally involved (i.e. given the opportunity to present their views to a board or some other authoritative body), this is done in the form of public hearings. Public hearings are structured, one-way forms of communication, and do not constitute an adequate forum to assert environmental rights; (5) in the body of federal and provincial legislation examined, the convening of a public hearing is a discretionary power given to the minister or official, not a requirement; (6) the exercise of this discretion could intensify political controversy surrounding any one issue because of a lack of formal channels to express legitimate discontent; and (7) the public has very little access to the formation of environmental policy through the conduct of public hearings as structured under the present federal and provincial legislation.[77]

Lucas (1976) agrees with Morley's findings, when he writes, "a selective review of Canadian federal and provincial environmental legislation and a full review of case law suggests that citizens' rights to participate in decisions by resource and environmental management agencies are not extensive."[79] Lucas also found evidence that suggested agencies with mandates for public participation were not using the process or were using it ineffectively.[80]

The legislation on which the public participation in the Nelson Watershed is based is found in the B.C. Ministry of Forests, *Forest Act* (1978), Section 4(c); the ministry "under the direction of the Minister must...plan the use of forest and range resources of the Crown, so that...other natural resource values are coordinated, and integrated, in consultation, and cooperation with other ministries, and agencies of the Crown, and with the private sector."[81] Narrow interpretation of the wording suggests that there is no provision for public

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[77]Morley, C.G., "The Legal Framework for Public Participation in Canadian Water Management," in *Environmental Management and Public Participation*, P.S. Elder (ed.), The Canadian Environmental Law Research Foundation and The Canadian Environmental Law Association, (1975), 40-41.
[79]Lucas, A.R., "Legal Foundations for Public Participation in Environmental Decision Making," *Natural Resources Journal*, 16 1 (1976), 102.
[80]Ibid.
[81]Province of British Columbia, *Forests Act*, (1978), Section 4(c).

involvement. However, the Deputy Minister of Forests, F.W. Apsey, in a paper titled *Resource Management in British Columbia*, given at a conference in 1978, stated that "public participation is not identified specifically in the Act, but as I mentioned earlier, Section 4 (c) requires 'consultation and cooperation with the private sector'. That includes the public at large. Also, Sections 8. 9. and 10 will tend to make Forest Service programs respond to public attitudes."[11] It is quite clear from the statements made that no specific mechanism for public participation is provided for in the legislation.

3.10.6 Techniques, Models, Limitations and Usefulness of Public Involvement

A superior model of public participation is formulated by Arnstein (1969), i.e., her "Ladder of Citizen Participation,"[12] which is shown in Figure 3.4. The figure displays the choice and extent of participation available to the public and public officials. One section of *Socioeconomic Evaluation in Timber Development Proposals*, prepared by Phillips *et al* (1981) also discusses a number of public participation models. They suggest that "the normal context for selecting the appropriate rung on the participation ladder is to think of how to get the bureaucracy's views and technical 'facts' across to the public in a palatable way. However, perhaps the more critical need is to hear, understand, and accommodate public concerns and priorities if discontent is to be minimized and benefits maximized."[14] In *Models and Techniques of Citizen Participation*, Connor (1977) observes that "in most cases where public participation becomes a 'problem', it is because the public agency:

> (1) does not understand the publics and the communities it is supposed to serve and lacks effective linkage with them; (2) does not provide its key planners and decision makers with accurate and timely information from its constituency in a usable form; and (3) does not respond in a visible and timely manner to community concerns, suggestions and information.[15]

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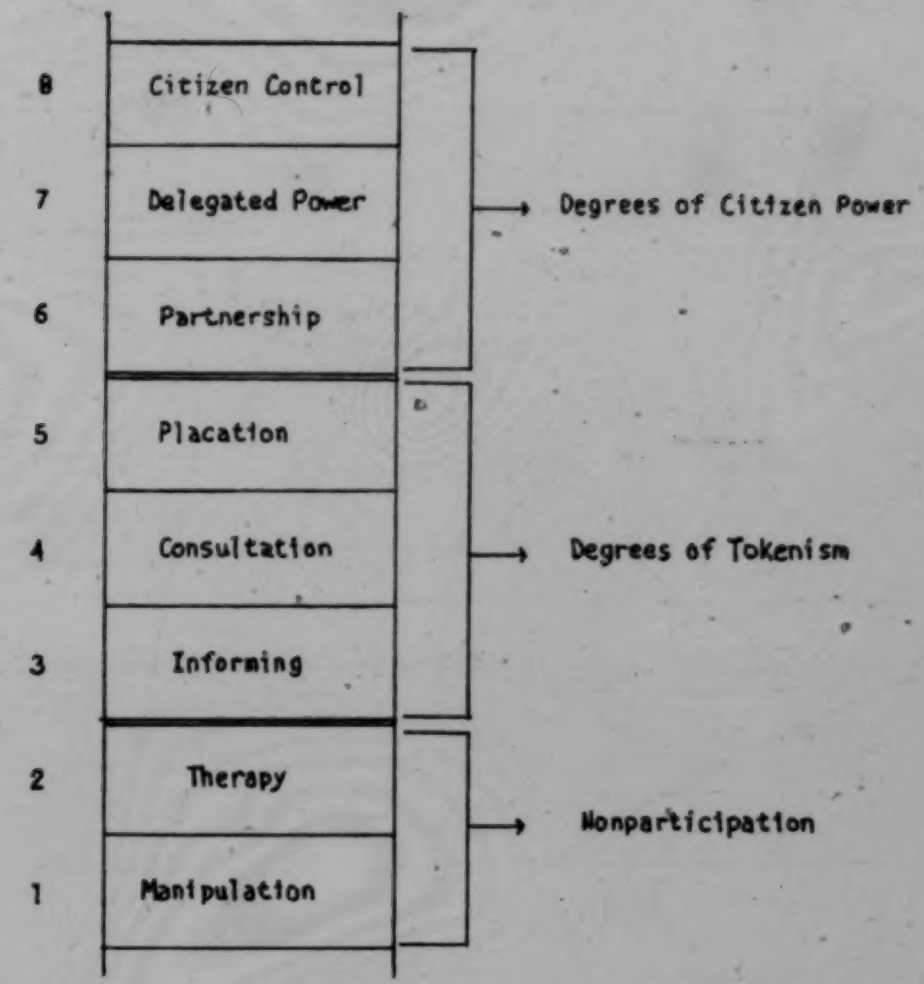
[11]Apsey (1978).
[12]Arnstein, S.R., "A Ladder of Citizen Participation," *Journal of the American Institute of Planners*, 35 (1969), 216-224.
[14]Phillips, W.E., L.P. Apedaile, M.R. Carroll, and T.S. Veeman, *The Role of Socioeconomic Evaluation in Timber Development Proposals in Alberta*, Final Report, Prepared by I.M.P.A.C.T. Environomics Ltd., for the Alberta Forest Service, June, 1981.
[15]Connor, D.M., "Models and Techniques of Citizen Participation," in B. Sadler



Source: Arnstein, 1969, p. 216.

Figure 3.4 Eight Rungs on the Ladder of Citizen Participation

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[15](cont'd) (ed.), *Involvement and Environment*, Vol. 1. (Edmonton, Alta.: Environment Council of Alberta, 1977), 64.

A summary of participation stages and techniques can be found in Connor (1974).[16] Phillips *et al* (1981) explain in some detail and rate 22 of the involvement techniques according to various criterion.[17]

3.11 A Useful Model of Public Involvement

Previous discussion has indicated that the process of public participation needs to undergo some degree of institutionalization. However, there must be resistance to the development of a structure that is too rigid in terms of its use and effectiveness. Environmental conflicts dealing with competition for scarce resources by interested parties often take on a multitude of forms. Public managers must be prepared to develop the appropriate procedure of public participation for any given situation. By continuing with the use of participation programs in situations of conflict, managers will learn from the mistakes made and will eventually develop the ability to quickly assess a given situation and implement an appropriate participation program. If, as the process of participation continues deficiencies are found in the methods being used, then the procedure must also be adapted to deal with the deficiencies. If changes in conditions alter the character of the situation initially assessed, then the methods in use must be adapted to deal with the new conditions.

In his review of a public participation program in the Okanogan Basin in southern B.C., O'Riordan (1976) summarizes some of the characteristics that a successful public involvement program should incorporate:

1. key individuals in the community should be identified and contacted at the beginning of the study to aid in definition of study scope and objectives;
2. task forces should be formed early but be designed around a flexible membership, for different people become interested at different phases of the study;
3. task forces should not have to meet so frequently that their membership has no opportunity to study the issues and to discuss them with other members of the community;

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[16]Connor, D.M., *Citizens Participate*, (Oakville, Ont.: Development Press, 1974).
[17]Phillips *et al*, pp. 129-137.

4. although reasonable efforts should be made to attract a broad cross-section of the community to these task forces, in practice only a core of key participants will remain;
5. the development of an open door policy permitting anyone to participate, coupled with a good public information program will generally unearth the committed citizens concerned about a specific issue under study;
6. this (5., above) will avoid the expenditure of manpower and resources to coax less committed citizens onto task forces who will drop out after awhile;
7. an attempt should be made to gain greater involvement of local political leaders at the municipal and regional levels;
8. the separation of power between the public and politicians should be communicated at the outset of the program;
9. the public can participate in the planning process and make recommendations for managing a specific resource, but politicians make final decisions involving trade-offs between resource management and other needs for the community within budget constraints; [88]
10. a successful public involvement program should be self-perpetuating, for it will raise the level of community awareness of other issues existing in the region.[89]

3.12 An Alternative Institutional Form for Public Agencies

This section briefly discusses the nature of the proposed alternative public agency form. The alternative is an expansion of an idea suggested by Carroll (1982). [90] The basic premise is that the existing public agencies must be integrated in a way that reduces the possibility of

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[88]"There is still considerable controversy over the extent that interest groups as well as advisory groups should be involved in the decision making process. Perhaps the best procedure might be for the general public and interest groups to be permitted, through some mechanism, to reveal their preferences for extra-market goods. This approach is suggested mainly because the decision maker will be relatively uncertain or biased in his determination of what is really preferred by interested groups and individuals. The participants must then be able to ascertain that their concerns have been heard, considered, and dealt with in the planning, policy formulation and decision making processes.
"O'Riordan, T., "The Public Involvement Program in the Okanogan Basin: A Study," *Natural Resources Journal*, 16 1 (1976), 194-196.

[90]Carroll (1982), pp. 358-364.

internal autonomy and conflict and instead promotes an internal interdisciplinary approach to planning, policy formulation and decision making. The function of the public agency should be to evaluate all resources, including extra-market goods, and the alternatives associated with them. An effort to remain neutral must be made when developing policies that ultimately lead to operative decisions.

Generally, public agencies are ideally suited to interpret politically determined goals, not the manufacture of its own set of goals. Thus, Carroll (1982) indicates that "the first and most important thing must be to make a requirement for detailed accountability of policy to the senior legislative body."[91] This detailed report might be comprised of social, economic, and environmental impact analyses.

Public agencies that are confronted with the dual problems of management and maximization of the social net benefit obtained from publicly owned resources encounter serious set backs in the attainment of these goals. The main reason for the set backs is that no operational method exists that can adequately determine and incorporate the value of and social preferences for extra-market goods in the calculation of the net social benefit of natural resources projects similar to the one proposed for the Nelson Watershed. Social preferences that are revealed tend to be disregarded by the public manager because he perceives that the information received may not be accurate enough and/or that his personal 'unbiased' value judgement is better in terms of planning or decision making, even if policy guidelines are vague. An acceptable process of public participation needs to be developed and incorporated into the public agency. If this can be done then as Carroll (1982) suggests, "it would be relatively simple to establish the correct procedures for the policy-neutral role of resource agencies: (1) accountability built in so that the detailed scrutiny of policy can be carried out, and (2) a direct appeal for public input in matters of value judgement on resources which must be allocated outside of the market place."[92]

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[91]Ibid., p. 362.
[92]Ibid., p. 363.

The development of a public agency that could resolve the conflict in the study area should consider incorporating the features described above. The B.C.F.S. is the obvious target of such a change but the change in character would not be effective unless the appropriate public participation form is used concurrently.

4. Scenarios, Land Use Alternatives and Opportunity Cost

4.1 Introduction

In order to deal with the valuation and trade-off problems discussed in earlier chapters an opportunity cost schedule approach was devised. The schedule shows the minimum value of intangibles which must be attained to justify a trade-off of timber resource use for water and amenity resource uses. The schedule was used in interviews to obtain preferences by group. The scenarios and land use alternatives that make up the opportunity cost schedules are described in subsequent sections. In addition, the generalized equations used to determine the opportunity costs for the schedules are also presented. The assumptions used in the derivation of opportunity cost are found in Appendix B.

4.2 Scenarios

Four opportunity cost schedules are developed, one for each of four scenarios. The four scenarios are listed as follows:

(a) Scenario #1 -Road Alternative #1
Harvest Period (1982-1990)

(b) Scenario #2 -Road Alternative #1
Harvest Period (1987-1995)

(c) Scenario #3 -Road Alternative #2
Harvest Period (1982-1990)

(d) Scenario #4 -Road Alternative #2
Harvest Period (1987-1995)

The harvest period totals nine years if the whole watershed is harvested in a first sweep through the area. Twenty percent of the mature and overmature volume is taken from each sub-drainage area on each sweep. All four scenarios incorporate a spatial separation of potential sub-drainage harvest areas. In addition, a temporal separation of the harvest period

(delay of harvest for five years) is used in scenarios 2 and 4. The nine year harvest breaks down in the following manner on a sub-drainage basis:

(i) Selous and Ward Creeks -2 years

Scenario #1 -1982-1983

Scenario #2 -1987-1988

Scenario #3 -1989-1990

Scenario #4 -1994-1995

(ii) Anderson/Fell/Hermitage Creeks -2 years

Scenario #1 -1984-1985

Scenario #2 -1989-1990

Scenario #3 -1987-1988

Scenario #4 -1992-1993

(iii) Five-Mile Creek -2 years

Scenario #1 -1986-1987

Scenario #2 -1991-1992

Scenario #3 -1985-1986

Scenario #4 -1990-1991

(iv) Turnstall and Eight-Mile Creeks -1 year

Scenario #1 -1988

Scenario #2 -1993

Scenario #3 -1984

Scenario #4 -1989

(v) Lasca Creek -2 years

Scenario #1 -1989-1990

Scenario #2 -1994-1995

Scenario #3 -1982-1983

Scenario #4 -1987-1988

4.2.1 Road Alternatives

There are two alternative road development plans for the Nelson Watershed (see Appendix B). In the first alternative the main haul road (Class 5) enters the Selous sub-drainage from the Salmo-Nelson highway south of Nelson. The road then continues at approximately the 1,200 meter level in a general north-easterly direction crossing creeks and connecting all the sub-drainages. Smaller drainage access roads (Class 6) would be constructed to access the merchantable trees in each drainage. In the second road alternative roads enter three sub-drainages (Lasca, Five-Mile and Selous) using the smaller sized drainage access roads (Class 6). Most of the sub-drainages in the Nelson Watershed would not be interconnected by roads and all of the sub-drainages would be developed by Class 6 roads.

Harvested logs would be hauled down the Class 5 road exiting the watershed at the edge of the Selous Creek sub-drainage, if road alternative 1 is constructed. If alternative 2 is used logs would be hauled down the roads exiting at the edge of the Selous Creek, Five-Mile Creek and Lasca Creek sub-drainages. In both alternatives, except with the logs hauled from Lasca Creek in road alternative 2 which would be boomed to Nelson, the logs would be hauled by truck to Nelson for milling. The exception being pulp sized logs which would be sent to the kraft pulp mill, 50 kilometers distant, at Castlegar.

In terms of total construction costs the second road alternative would cost less than the first road alternative. However, in terms of long-run hauling costs, the higher adverse grades of the second road alternative would lead to higher delivered wood costs; it would also be more efficient in terms of forest protection if the first alternative, which connects sub-drainages, was

constructed.[93] Consideration must also be given to the less environmentally disruptive action of constructing smaller (Class 6) roads in the whole watershed. This effect would be intangible in nature and could only be determined with study and conclusively only by actual construction in the watershed.

4.3 The Land Use Alternatives

The land use alternatives that comprise the opportunity cost schedule in each scenario are described above. Each land use alternative involves the withdrawal of one of the combined or single sub-drainages from the total watershed area (17,854 ha.'s) that are allocated for harvesting at some time during the first sweep.

Having two possible road alternatives allows for a number of spatial withdrawals. The direction of withdrawal moves sequentially from the north-east in Scenarios 1 and 2 and from the south-west in Scenarios 3 and 4. The withdrawals move in these directions because the origin of road construction constrains the sub-drainage that could feasibly be harvested first and so on.

Under normal operating conditions, a road would not be pushed into an area unless harvesting in the area is being considered at some point in time. Since road construction and maintenance practices would play the primary role in creating disturbances in a particular sub-drainage, and with harvesting activity generally playing only a secondary role, a larger portion of the intangible costs attributable to development of the area stems from road construction and maintenance. Therefore, pushing a road into an area to extract the timber in a more distant sub-drainage and then withdrawing it from harvesting makes little sense on practical terms; if the road could not be closed by Provincial order because of legal action on the part of recreation groups, then road construction would again play a major role in reducing the intangible benefits associated with water that is at present relatively free of potential health hazards.

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[93]Based on personal conversation with B.C.F.S. personnel.

By assuming (a) that the road would not be constructed in areas not allocated for harvest and (b) that the road would be supervised and closed (after completion of harvest), the dual problems of having to consider intangible benefits associated with individuals who enjoy four-wheel driving, for example, and the potential intangible costs (e.g., reduction in water quality) associated with their entry into the area can be eliminated to some extent. However, the potential health hazard and intangible costs associated with road construction (accidential fuel dumps, etc.), maintenance, and harvesting activity, i.e., having men and machines working near creeks, still exist even if the road were supervised.

In summary, there are six land use alternatives per scenario, ranging from the extreme of allocating the full watershed area for timber harvest, to the other extreme of designating the whole land unit for watershed protection, aesthetics and dispersed forms of outdoor recreation. Between these two limits marginal changes (withdrawals by sub-drainage) comprise the remaining land use alternatives.

4.4 Calculation of Opportunity Cost (Net Present Value)

The generalized equation that was used to calculate the net present value of harvesting in a sub-drainage is given below:

$$1.\quad NPVijk = [TRijk - TOMCijk - (TRCijk - TSCijk)]/(1 + r)^{x}$$

With the variables defined as follows:

NPV = Net Present Value (dollars)

TR = Total Revenue (dollars) per year

TOMC = Total Operating and Milling Costs (dollars) per year

TRC = Total Road Costs (dollars) per year

TSTC = Total Stumpage Costs (dollars) per year

i = Scenario Number (#1, #2, #3, or #4)

j = Land Use Alternative or Sub-drainage Harvested

r = Real Annual Discount Rate (percent)

x = Years After First Harvest to the Present (1 to 14)

k = Year of Harvest (1982 to end of 1995)

The following material describes the calculation of the variables defined above.

Total revenue (annual basis) is calculated using the following formula:

a. $TR_{ijk} = LR_{ijk} \times PCL_{ijk} + PR_{ijk} \times PCP_{ijk}$

The variables are defined as follows:

TR = Total Revenue (dollars)

LR = Lumber Recovered (mfbm)(see formula below)

PR = Pulp Recovered (see below)

PCL = Price of Lumber (dollars/mfbm)(SPF Group-Planed)(Annual Average)

PCP = Price of Pulp (dollars/adt)(Air Dried Bleached Kraft)(Annual Average)

i = (defined above)

j = (defined above)

k = Year of Harvest (defined above)

The lumber recovered from a given volume of wood is defined as follows:

1) $LR = N \times LRF \times (1 - 0.5D/G)$

The variables are defined below:

LR = Lumber Recovered (mfbm)

N = Net Volume (m^3) (G -D)

LRF = Lumber Recovery Factor for Sound Logs ($mfbm/m^3$)

see Appendix B for the LRF of individual tree species

D = Decay Volume (m^3/tree) (2.5% of G)

G = Gross Volume (m^3)

The air dried pulp (10% M.C.) recovered from a given volume of wood is as follows:

2) PR = m^3 green wood, approximately 50% loss in the pulping process and 6% in the bleaching process (see Appendix B).

3) PCL and PCP = the prices used for lumber and air dried pulp appear as in Table 4.1.

The second variable of the generalized formula in (1.) above concerns operating and milling costs (TOMC). The assumptions associated with the operating costs are found in Appendix B. Average operating and milling costs for each harvest year are listed below (see Table 4.2):

b. $TOMC_{ijk} = LR_{ijk} \times AOMCL_{ijk} + PR_{ijk} \times AOMCP_{ijk}$

The variables are defined as follows:

TOMC = (defined above)

LR = (defined above)

AOMCL = Average Operating and Milling Costs for Lumber ($'s/mfbm)

AOMCP = Average Operating and Milling Costs for Pulp ($'s/adt)

i = (defined above)

j = (defined above)

k = (defined above)

The stumpage charged to the harvesting company is based upon the stumpage appraisal system now in place in British Columbia. The formula to determine the stumpage value of wood harvested (pulp and saw) is presented below:

Table 4.1 Lumber And Pulp Prices

Year of Harvest	Dollars /MFBM	Dollars /ADT
1982	153.75	550.00
1983	194.75	615.34
1984	266.50	688.44
1985	307.50	770.22
1986	389.50	861.72
1987	348.50	964.09
1988	430.50	1078.62
1989	512.50	1206.76
1990	594.50	1350.15
1991	642.10	1510.59
1992	693.47	1690.00
1993	658.80	1890.77
1994	711.50	2115.40
1995	768.42	2366.71

Table 4.2 Average Operating And Milling Costs

Year of Harvest	Dollars /MFBM	Dollars /ADT
1982	150.00	350.00
1983	168.00	392.00
1984	188.00	438.00
1985	210.00	490.00
1986	235.00	548.00
1987	263.00	614.00
1988	294.00	686.00
1989	329.00	768.00
1990	368.00	859.00
1991	412.00	961.00
1992	461.00	1075.00
1993	516.00	1203.00
1994	577.00	1346.00
1995	645.00	1506.00

c. $TSC_{ijk} = SVS_{ijk} \times VSH_{ijk} + SVP_{ijk} \times VPH_{ijk}$

The variables are defined below:

TSC = Total Stumpage Costs (dollars)

SVS = Stumpage Value of Sawlogs (dollars/m^3)

SVP = Stumpage Value of Pulplogs (dollars/m^3)

VSH = Volume of Sawlogs Harvested (m^3)

VPH = Volume of Pulplogs Harvested (m^3)

i = (defined above)

j = (defined above)

k = (defined above)

The following equation demonstrates how the stumpage values are calculated. The equation is used by the British Columbia Forest Service to calculate the stumpage rate for wood harvested.

1) $SVS_{ijk} = CR_{ijk} - (PCL_{ijk} - (PCL_{ijk}/MPR))$

The variables are defined as follows:

SVS = (defined above)(equation also applies to pulplogs)

CR = Conversion Return = $PCL_{ijk} - AOMCL_{ijk}$

PCL = (defined above)

AOMC = (defined above)(units changed to dollars/m^3)

MPR = Margin for Profit and Risk = 1.20 (20% of AOMCL)

i = (defined above)

j = (defined above)

k = (defined above)

The stumpage values derived are presented in Table 4.3.

Total road costs are also calculated and are included as a separate variable in the net present value equation. This is done to allow subtraction of total stumpage costs from the total road costs. If the total stumpage costs are larger than the total road costs then the difference is subtracted from total revenue. In this chapter two different road alternatives are described. The formula used to calculate total road costs is as follows:

d. $TRC_{ijkl} = TRCC_{ijkl} + TBCC_{ijkl} + TCCC_{ijkl}$

The variables are defined below:

TRC = (defined above)(dollars)

TRCC = Total Road (Class 5 and 6) Construction Costs (dollars)

TBCC = Total Bridge Construction Costs (dollars)

TCCC = Total Culvert Construction Costs (dollars)

l = Road Alternative (#1 or #2)

i = (defined above)

j = (defined above)

k = (defined above)

Total road costs for the two road alternatives are presented in Table 4.4.

4.5 Example of Opportunity Cost Net Present Value Calculation (Selous and Ward Creeks)

The example opportunity cost calculation that follows makes up one part of an opportunity cost schedule. The schedule that the calculation is taken from is based on Scenario #1. The calculation below describes the derivation of the opportunity cost (net present value) of the first year (1982) of a two year (1982 and 1983) timber harvest and road construction

Table 4.3 Stumpage Values For Sawlogs(SVS) and Pulplogs(SVP)

Year of Harvest	SVS ($'s/m^3)	SVP ($'s/m^3)
	Scenario #1 and #3	Scenario #1 and #3
1982	0.00	19.34
1983	0.00	21.57
1984	8.35	24.24
1985	11.35	27.12
1986	21.92	30.32
1987	6.73	33.76
1988	15.69	37.94
1989	23.95	41.26
1990	31.12	52.20
	Scenario #2 and #4	Scenario #2 and #4
1987	6.74	33.83
1988	15.98	38.01
1989	24.03	42.44
1990	31.22	47.53
1991	30.23	53.09
1992	28.72	59.42
1993	7.99	66.43
1994	3.89	72.37
1995	0.00	80.92

woods operation in the Selous and Ward Creek sub-drainages.

1. $NPVijk = TRijk - TOMCijk - (TRCijk - TSCijk)/(1 + r)^{x}$

2. $\$103,375.72 = 1\,188\,391.59 - 936\,776.50 - (174\,109 - 31\,416.42)/(1.05)^{1}$

   a. i = Scenario #1, Road Alternative #1

   b. j = Selous and Ward Creeks Harvested

   c. k = Year of Harvest is 1982

   d. x = Years After First Harvest to the Present is 1

e. r = Real Discount Rate = 5%

3. TRijk = LRijk x PCLijk + PRijk x PCPijk

4. $1 188 391.59 = 3 461.09(mfbm) x 153.75($/mfbm) + 1 193.18(mfbm) x 550.00($/mfbm)

5. LRijk = Nijk x LRFijk x (1 -0.5Dijk/Gijk)

6. see Appendix B -the LRF is species variable

7. see Appendix B -the PR is species variable

8. TOMCijk = LRijk x AOMCLijk + PRijk x AOMCPijk

9. $936 776.50 = 3 461.09(mfbm) x 150.00($/mfbm) + 1 193.18(adt) x 350.00($/adt)

10. TSCijk = SVSijk x VSHijk + SVPijk x VPHijk

11. $31 416.42 = 0.00($/m³) x 14 619.84(m³) + 19.34($/m³) x 1 624.427

1. SVSijk = CRijk -(PCLijk -(PCLijk/MPR))

2. -5.38($/m³) = 0.00($/m³) = 0.92($/m³) -(37.80($/m³) -37.80($/m³)/1.20))

   a. CRijk = PCLijk -AOMCLijk

   b. 0.92($/m³) = 37.80($/m³) -36.88($/m³)

3. SVPijk = CRijk -(PCPijk -(PCPijk/MPR))

4. 19.34($/m³) = 35.71($/m³) -(98.21($/m³) -(98.21($/m³)/1.20))

   a. CRijk = PCPijk -AOMCPijk

   b. 35.71($/m³) = 98.21($/m³) -62.50($/m³)

5. TRCijkl = TRCCijkl + TBCCijkl + TCCCijkl

6. ($)174 109 = 134 939($) + 27 419($) + 11 751($)

The net present value (1982) determined above when added to the net present value determined for 1983; totals $284 520.18. This value is found under the Timber Harvest ($'s) column in Table 4.7.

Table 4.4 Total Construction Costs

Year of Harvest	Dollars (Alt.#1)	Dollars (Alt.#2)
	Scenario #1 and #3	Scenario #1 and #3
1982	174 109	496 045
1983	194 793	554 759
1984	189 413	156 893
1985	211 914	411 759
1986	475 099	375 324
1987	531 540	118 441
1988	808 897	132 512
1989	664 693	248 551
1990	743 659	278 079
	Scenario #2 and #4	Scenario #2 and #4
1987	305 200	869 527
1988	341 457	972 827
1989	332 025	275 022
1990	371 470	721 782
1991	832 810	807 529
1992	931 748	207 617
1993	1 417 931	232 282
1994	1 165 154	435 690
1995	1 303 575	487 450

4.6 Socioeconomic Impact of the Land Use Alternatives

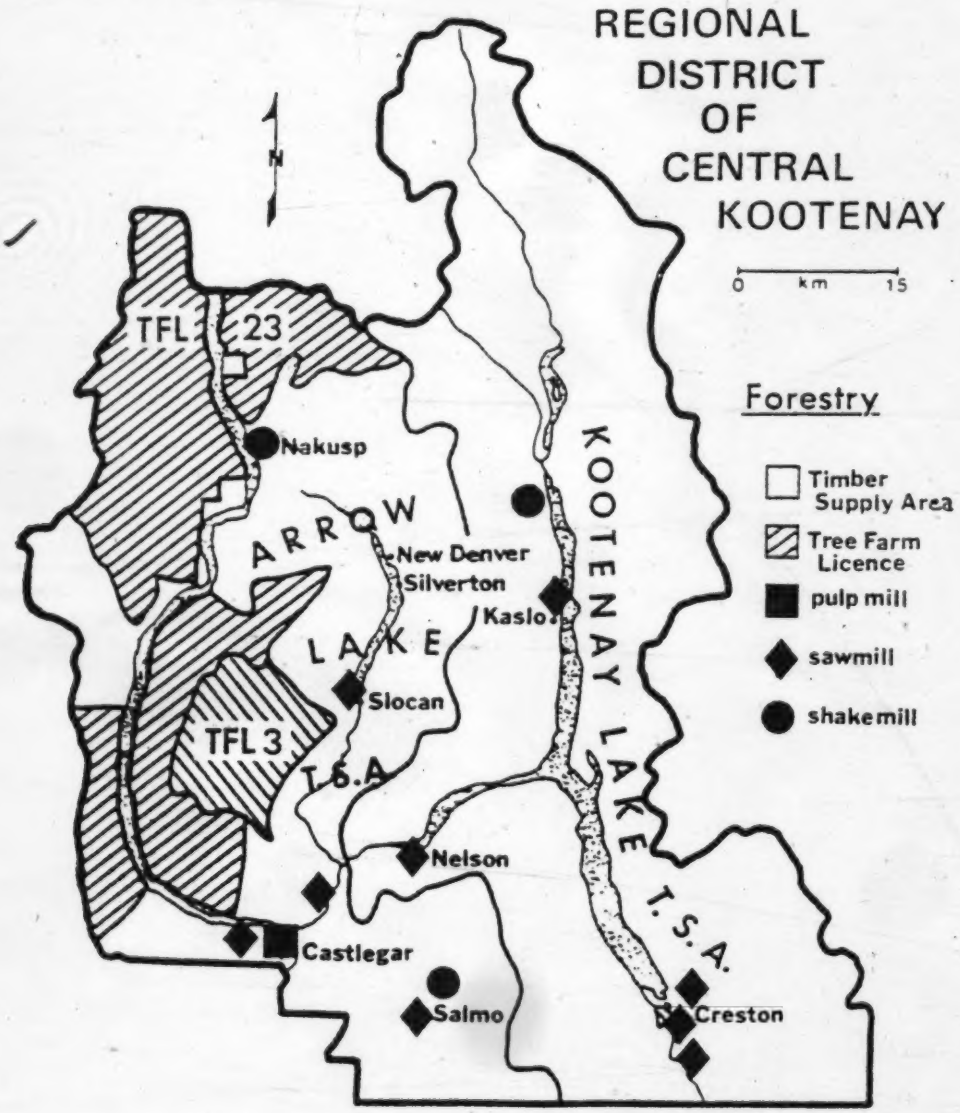
For each land use alternative or withdrawal of land from harvesting there are two potential effects or monetary costs involved; the first is the loss in net present value that the company would experience and the second is the socioeconomic costs involved with the loss of a portion of the watershed wood supply.

The calculated socioeconomic cost consists of the loss of income spent in the Nelson locale by forestry sector workers. It is assumed that the wood supply lost because of withdrawal

does not allow the pulp and lumber mills involved in processing to operate at full capacity. This results in greater unemployment that is a certain percentage of the mill and woodlands workers normally employed. The percentage of lost jobs is dependent upon the volume of timber lost by withdrawal as a percentage of mill (pulp and lumber) capacity. For this scenario to be feasible an assumption must be made that the mills are dependent upon the watershed wood to operate at least in the short-run at full capacity, i.e., the extra volume required is not economically available elsewhere in the Kootenay Lake T.S.A. Further, if the wood is physically available, the total cost of harvesting and transporting the wood would force the company in the short-run to raise its price for processed wood to recover the increased costs of production. In the existing competitive domestic and foreign markets this price change may result in a decline in demand for the company's pulp or lumber. If the rules of supply and demand are applied in this situation, the company experiences an increase in its wood inventories. What is more likely, since most forest sector companies generally maintain large inventories of wood, is that there is a loss in jobs over a period of time. Thus, in either case, there is a reduction in the number of individuals employed in the forest sector.

In addition to the jobs affected in the forest sector, the linkage effect of jobs created in other sectors by the existence of forestry sector employment and activity must be considered. If forest sector jobs are lost, then a given multiple number of employees in other sectors can be assumed to lose their jobs. This increase in unemployment also results in the loss of income spent in the Nelson locale. In terms of 'spinoff' effects or costs resulting from the loss of jobs in any localized area one may add up these costs to the national level. However, because of the conditions existing in the Nelson Forest Region, the socioeconomic costs are only calculated for the Regional District of Central Kootenay (see Plate 4.1) for which an economic profile has been completed.

The monetary and socioeconomic costs, i.e.,the loss in company income and forestry and peripheral sector income spent in the R.D.C.K., is presented separately on the opportunity cost schedule so that a more explicit picture of the costs of withdrawing land from harvesting



Source: Lauer, 1982.

Plate 4.1 The Regional District of Central Kootenay

for a short period of time may be seen by the individuals interviewed.

4.7 Calculation of Opportunity Cost (Socioeconomic Impact)

The following material describes the generalized equations used to calculate the net income effect of withdrawing portions of the Nelson Watershed from harvesting. The generalized formula that is used to to calculate the income effect is defined below:

1. $NIEijk = (NAYDIijk \times TJLijk)/(1 + r)^{x}$

The variables used in the equation are defined below:

NIE = Net Income Effect (dollars)

NAYDI = Net Average Yearly Disposable Income (dollars)

TJL = Total Jobs Lost (number of workers)

r = Real Rate of Interest (percent)

x = Years After First Harvest to the Present (1 to 14)

i = Scenario Number (#1, #2, #3 or #4)

j = Land Use Alternative or Sub-drainage Harvested

k = Year of Harvest (1982 to end of 1995)

The derivation of NAYDI can be seen below:

a. $NAYDI = NAYI - (NAYI \times 0.5)$

The variables are defined as follows:

NAYDI = (defined above)

NAYI = Net Average Yearly Income (dollars)

The derivation of NAYI is as follows:

1) $NAYI = GAYI \times (1 + 0.1)^1 - (GAYI - 0.2)$

The variables are defined as follows:

NAYI = (defined above)

GAYI = Gross Average Yearly Income (dollars)

Tables 4.5 and 4.6 below describe the data that was used to determine the net income effect for the four scenarios. The net income effects based on this data are also shown.

4.8 Example of Opportunity Cost Socioeconomic Impact Calculation (Selous and Ward Creeks)

The calculation shown below deals strictly with the income effect that is created if forestry sector workers and workers in linked sectors are unable to work. The example calculation illustrates the socioeconomic (net income effect) effect of withdrawing the timber of the Selous and Ward sub-drainages that would be harvested in 1982.

1. $NIEijk = (NAYDIijk \times TJLijk)/(1 + r)$
2. ($)419 074.56 = (9 907.2($/year) x 42.3(man years)/$(1 + .05)^6$

   Note, 1982 salaries were not discounted because the payments would be spread over the whole year. Following years were discounted.

   a. NAYDI = NAYI -(NAYI x 0.5)
   b. ($)9 907.2 = 19 814.4($) -(19 814.4($) x 0.5)
   c. NAYI = GAYI x (1 + 0.1) -(GAYI x 0.2)
   d. ($)19 814.4 = 24 768($) x $(1 + 0.1)^6$ -(24 768($) x 0.2)

All of the assumptions with respect to the calculations above, i.e., harvesting, volumes etc., may be found in Appendix B. The example calculations above make up only a small part of the total opportunity cost schedule. The results for all four scenarios are displayed in Tables 4.7, 4.8, 4.9, and 4.10. Graphical presentations of the tables above are found in Figures 4.1,

Table 4.5 Employment Lost From Mill Capacity Change

Year of Harvest	Processed Volume % of Mill Capacity		Jobs Lost			
	Saw	Pulp	Saw	Pulp	Other	Total
1982* or 1987**	6.29	0.68	12.5	4.4	25.4	42.3
1983 or 1988	6.29	0.68	12.5	4.4	25.4	42.3
1984 or 1989	7.30	0.82	14.5	5.3	29.7	49.5
1985 or 1990	7.30	0.82	14.5	5.3	29.7	49.5
1986 or 1991	20.51	2.14	40.8	13.9	82.1	136.8
1987 or 1992	20.51	2.14	40.8	13.9	82.1	136.8
1988 or 1993	31.05	3.39	61.8	22.0	125.7	209.5
1989 or 1994	30.78	3.25	61.3	21.0	123.5	205.8
1990 or 1995	30.78	3.25	61.3	21.0	123.5	205.8

* Scenario #1, Road Alternative #1.
** Scenario #2, Road Alternative #1

Year of Harvest	Processed Volume % of Mill Capacity		Jobs Lost			
	Saw	Pulp	Saw	Pulp	Other	Total
1982* or 1987**	30.78	3.25	61.3	21.0	123.5	205.8
1983 or 1988	30.78	3.25	61.3	21.0	123.5	205.8
1984 or 1989	31.05	3.39	61.8	22.0	125.7	209.5
1985 or 1990	20.51	2.14	40.8	13.9	82.1	136.8
1986 or 1991	20.51	2.14	40.8	13.9	82.1	136.8
1987 or 1992	7.30	0.82	14.5	5.3	29.7	49.5
1988 or 1993	7.30	0.82	14.5	5.3	29.7	49.5
1989 or 1994	6.29	0.68	12.5	4.4	25.4	42.3
1990 or 1995	6.29	0.68	12.5	4.4	25.4	42.3

* Scenario #3, Road Alternative #2.
** Scenario #4, Road Alternative #2

Table 4.6 Net Average Yearly Income And Net Income Effect

Year of Harvest	NAYI	NIE*	NIE**
1982	19 814.40	419 074.56	2 038 901.76
1983	21 795.84	439 376.45	2 135 992.32
1984	23 975.42	538 223.72	2 227 936.73
1985	26 372.97	563 853.58	1 558 286.27
1986	29 010.26	1 614 990.40	1 632 489.99
1987	31 911.29	1 710 644.55	618 832.44
1988	35 102.42	2 743 817.97	648 300.67
1989	38 612.66	2 770 373.12	580 383.42
1990	42 473.93	2 958 651.18	608 020.79
Totals		13 759 005.18	12 099 144.39
1987	31 911.29	533 404.37	2 572 842.73
1988	35 102.42	558 804.62	2 695 359.13
1989	38 612.66	679 172.08	2 874 475.82
1990	42 473.93	711 513.68	1 966 365.09
1991	46 721.32	2 060 503.35	2 060 001.39
1992	51 393.45	2 158 622.47	780 890.22
1993	56 532.80	3 462 354.00	818 075.54
1994	62 186.08	3 563 750.60	732 372.39
1995	68 404.68	3 733 452.58	767 247.18
Totals		17 461 577.75	15 267 629.49

* Net Income Effect for Scenarios #1 and #2.
** Net Income Effect for Scenarios #3 and #4.

Table 4.7 Opportunity Cost Schedule Used in Interview Procedure (Scenario #1)

Land Use Alternatives	Water Aesthetics and Recreation (ha.'s)	Change in Ha.'s	Change in N.P.V.	Timber Harvest ($'s)	N.I.E. ($'s)	Change in N.I.E
Full Allocation	0			13 613 455.21	13 759 005.61	
		6 659	5 888 781.4			5 729 024.30
Lasca Cr.	6 659			7 724 673.81	8 029 981.31	
		2 215	2 849 469.64			2 743 817.97
Turnstall/8-Mile Cr.'s	8 874			4 875 204.17	5 286 163.34	
		5 462	3 385 454.51			3 325 634.95
Five-Mile Cr.	14 336			1 489 749.66	1 960 528.39	
		1 767	1 205 229.48			1 102 077.30
Anderson/Fell/Hermitage Cr.'s	16 103			284 520.18	858 451.09	
		1 751	284 520.18			858 451.01
Selous/Ward Cr.'s	17 854			0	0	
	Total Change (ha.'s)	17 854	13 613 455.21	Total Change ($'s)	Total Change ($'s)	13 759 005.61

* Average = 762.49 $'s/ha.
NEI = Net Income Effect

Table 4.8 Opportunity Cost Schedule Used in Interview Procedure (Scenario #2)

Land Use Alternatives	Water Aesthetics and Recreation (ha.'s)	Change in Ha.'s	Change in N.P.V.	Timber Harvest ($'s)	N.I.E. ($'s)	Change in N.I.E
Full Allocation	0			15 584 228.67	17 461 577.75	
		6 659	5 204 606.98			7 297 203.18
Lasca Cr.	6 659			10 379 621.69	10 164 374.57	
		2 215	3 133 540.80			4 219 125.82
Turnstall/8-Mile Cr.'s	8 874			7 246 080.89	6 702 020.57	
		5 462	5 328 410.80			4 219 125.82
Five-Mile Cr.'s	14 336			1 917 670.09	2 482 894.75	
		1 767	1 867 800.01			1 390 685.76
Anderson/Fell/Hermitage Cr.'s	16 103			849 870.08	1 092 208.99	
		1 751	849 870.08			1 092 208.99
Selous/Ward Cr.'s	17 854			0	0	
	Total Change (ha.'s)	17 854	15 584 228.67	Total Change ($'s)	Total Change ($'s)	17 461 577.75

* Average = 872.87 $'s/ha.
NIE = Net Income Effect

Table 4.9 Opportunity Cost Schedule Used in Interview Procedure (Scenario #3)

Land Use Alternatives	Water Aesthetics and Recreation (ha.'s)	Change in Ha.'s	Change in N.P.V.	Timber Harvest ($'s)	N.I.E. ($'s)	Change in N.I.E
Full Allocation	0			9 765 918.79	12 099 144.39	
		1 751	1 384 487.63			1 188 404.21
Selous/Ward Cr.'s	1 751			8 381 431.76	10 910 740.18	
		1 767	1 226 657.58			1 267 133.11
Anderson/Fell/Hermitage Cr.'s	3 518			7 154 774.18	9 643 607.07	
		5 462	3 243 180.99			3 190 776.26
Five-Mile Cr.	8 980			3 911 593.19	6 452 830.81	
		2 215	1 877 308.39			2 277 936.73
Turnstall/8-Mile Cr.'s	11 195			2 034 284.80	4 174 894.08	
		6 659	2 034 284.80			4 174 894.08
Lasca Cr.	17 854			0	0	
	Total Change (ha's)	17 854	9 765 918.79	Total Change ($'s)	Total Change ($'s)	12 099 144.39

* Average = 546.99 $'s/ha.
NIE = Net Income Effect

Table 4.10 Opportunity Cost Schedule Used in Interview Procedure (Scenario #4)

Land Use Alternatives	Water Aesthetics and Recreation (ha.'s)	Change in Ha.'s	Change in N.P.V.	Timber Harvest ($'s)	N.I.E. ($'s)	Change in N.I.E
Full Allocation	0			15 308 120.56	15 267 629.49	
		1 751	1 149 814.01			1 499 619.57
Selous/Ward Cr.'s	1 751			14 158 306.55	13 768 009.92	
		1 767	1 680 048.53			1 598 965.76
Anderson/Fell/Hermitage Cr.'s	3 518			12 478 258.02	12 169 044.16	
		5 462	4 467 649.38			4 026 366.48
Five-Mile Cr.	8 980			8 010 608.64	8 142 677.68	
		2 215	2 642 651.80			2 874 475.82
Turnstall/8-Mile Cr.'s	11 195			5 367 956.84	5 268 201.86	
		6 659	5 367 956.84			5 268 201.86
Lasca Cr.	17 854			0	0	
	Total Change (ha.'s)	17 854	13 613 455.21	Total Change ($'s)	Total Change ($'s)	15 267 629.49

* Average = 857.41 $'s/ha.
NIE = Net Income Effect

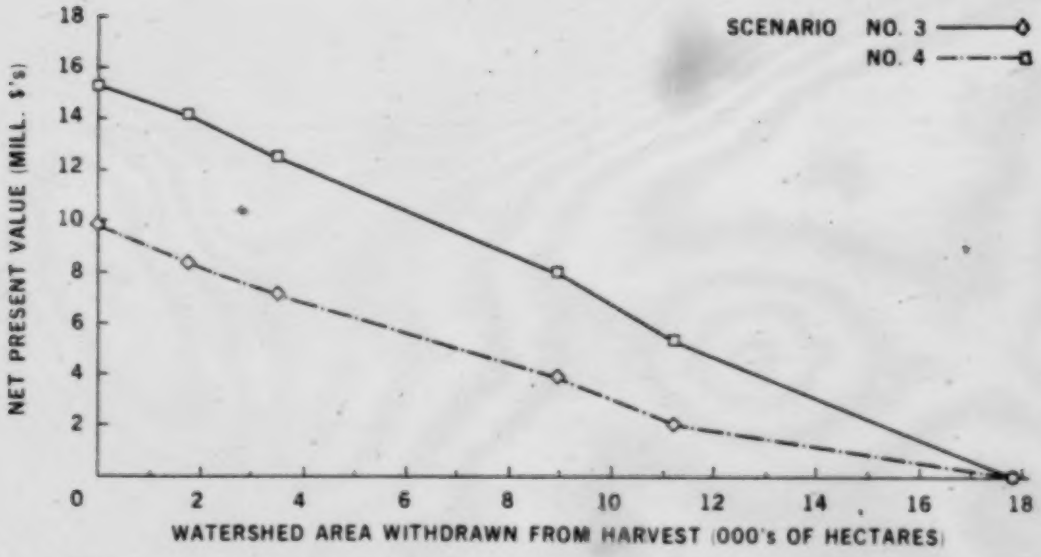


Figure 4.1 Net Present Value of Watershed Area Withdrawn from Harvest (Scenarios 1 and 2)

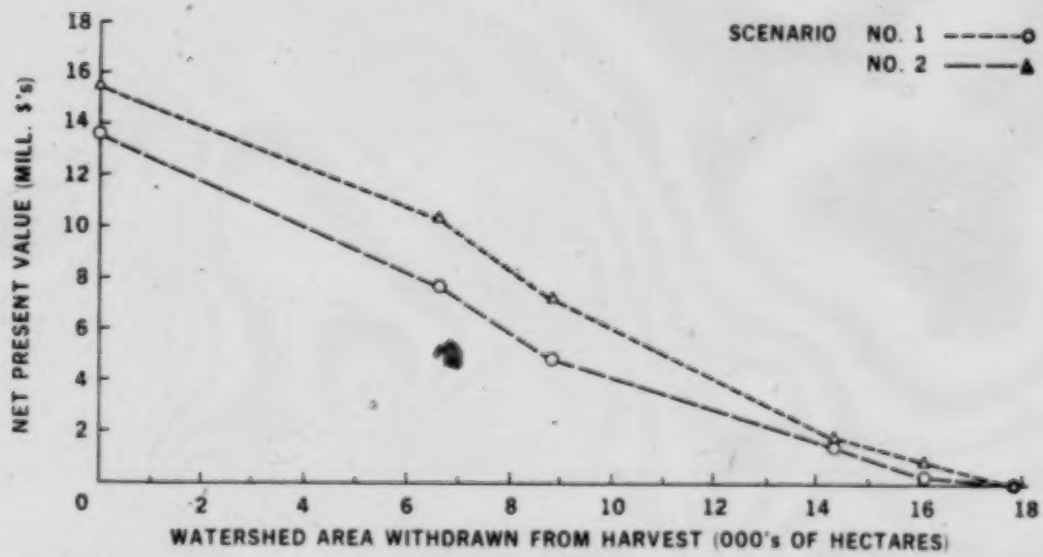


Figure 4.2 Net Present Value of Watershed Area Withdrawn from Harvest (Scenarios 3 and 4)

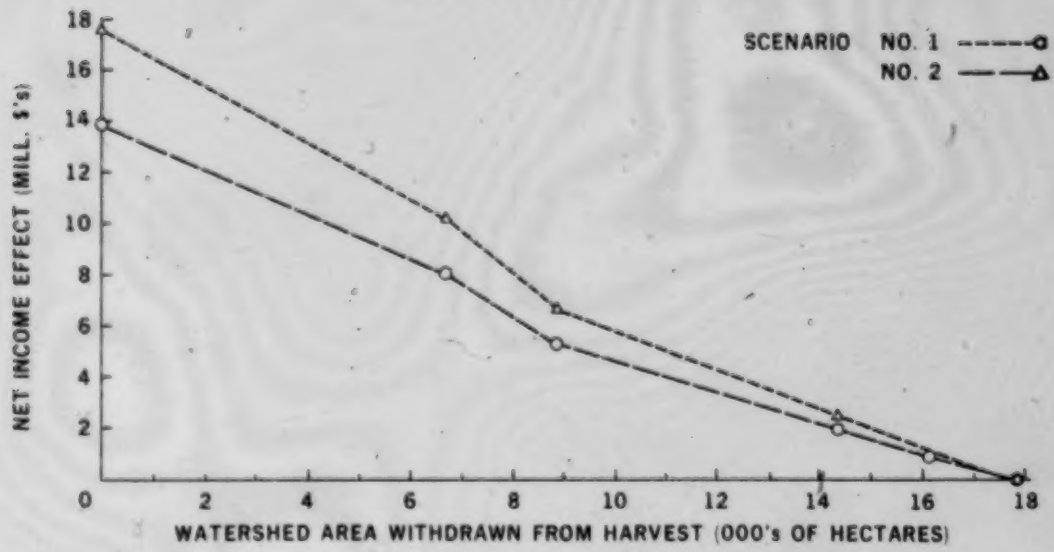


Figure 4.3 Net Income Effect of Watershed Area Withdrawn from Harvest (Scenarios 1 and 2)

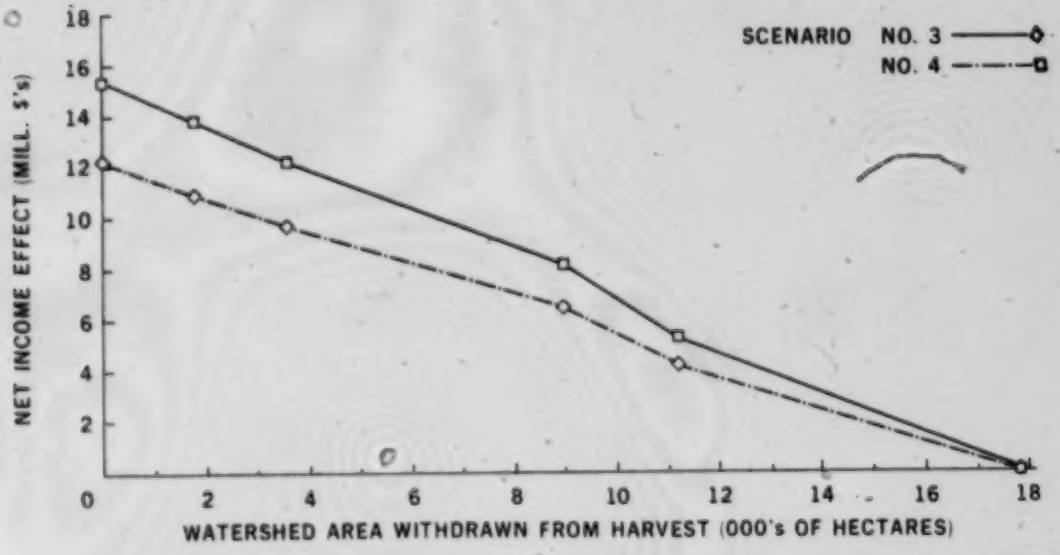


Figure 4.4 Net Income Effect of Watershed Area Withdrawn from Harvest (Scenarios 3 and 4)

4.2, 4.3 and 4.4 below. These figures allow for a comparison of the net present value and net income effects of the four scenarios.

4.9 The Use of the Opportunity Cost Schedule

The opportunity cost schedules calculated show the benefits in terms of net present value and net income effect of different timber harvest plans. The choice of a less extreme harvesting plan (i.e., leaving out some sub-drainages) implies incurring an opportunity cost of timber revenues foregone. If decision makers decide to leave a sub-drainage unharvested, in order to preserve existing uses, the rational economic basis for such a decision should be that the benefits from the existing uses are at least equal to the opportunity cost of foregoing timber revenues. The preservation of sub-drainages in the Nelson Watershed would maintain existing water and amenity uses. To economically justify preserving a sub-drainage implies assigning a critical minimum value to these intangibles.

The trade-off described in the opportunity cost schedule can be used to guide agency decisions (B.C.F.S.) in defining a harvest-plan which maximizes net benefits. The assigning of a minimum value to intangibles is of course the difficult part of the process and in the absence of a precise valuation technique depends upon value judgements by B.C.F.S. decision makers. The method of establishing the trade-offs described above is felt to make a contribution towards effective decision making. The trade-off can be used to focus discussion by the planning team or in other public input processes. The schedule was used in an interview procedure with members of the planning team. The interview procedure is explained in Chapter 5.

5. Interview Procedure

5.1 Introduction

In order to investigate the land use trade-offs in the Nelson Watershed an interview procedure was undertaken in Nelson, British Columbia in May, 1982. The following sections describe the interview procedure used.

5.2 Interview Procedure-Outline

An outline of the interview procedure is set out below:

1. Interview Introduction
2. Background Information Questionnaires
   a. Group
   b. Individual
3. Education
   a. Nelson Watershed Resources Overview
   b. Assumptions used in Determining Road Construction and Harvesting Costs
   c. Socioeconomic Characteristics Overview
   d. Nelson Watershed Conflict Issues Overview
4. Evaluation of Trade-offs
   a. Introduction
   b. Opportunity Cost Schedule and Scenarios
   c. Schedule Land Use Alternatives
   d. Choice.

The following sections expand upon the foregoing outline.

5.3 Overview of the Interview Procedure

Representatives of interest groups, government and industry that have concerns over the use of the Nelson Watershed are identified and interviews set up with them. The interview technique used is left flexible so that varied conditions, i.e., different personalities, situations, etc., could be dealt with easily during the course of the interview.

After a personal introduction, the topic under investigation is described to the individual along with a statement defining the interview content. This procedure amounts to a brief description of steps 2, 3 and 4 outlined in the previous section. Following the introduction questionnaires are administered to the interview participants.

5.4 Background Information Questionnaires

To obtain information on the background and concerns of the individuals and groups involved, two questionnaires (see Appendix C) are filled in by the interview participants. The first is oriented towards the individual and the second to the interest group, government agency or firm the individual represents. The purpose of the individual questionnaire is to reveal some important aspects of the background and nature of the responding individual. The questionnaire is also used to discover what the individual thinks and feels about the land use issues of the Nelson Watershed as they relate to the individual and to other groups. Individual views of the most socially beneficial way to use the Nelson Watershed's resources are also elicited. Thus, by completing the questionnaire, ascertainment of why an individual chooses a particular land use alternative on an opportunity cost schedule might be clarified. Ultimately, the individual questionnaire attempts to reveal personal motivations, biases and preferences that influence the choice of a land use alternative, why the individual belongs to a particular interest group, etc., and his or her interpretation of its aims. Those individuals interviewed are also asked to complete the group questionnaire. Use of the group questionnaire assists in revealing why there are differences in the choice of a land use alternative. The group questionnaire is also used to reveal aggregate group aims, policies of public agencies or

objectives of firms that the representing individual believes exist at the time of the interview.

There are two additional objectives of both questionnaires. The first is to determine the extent to which interest group aims are heard by public agencies or firms from the point of view of the interest group or alternatively by the public agency or firm. The second is to discover how, and to what extent, interest group aims have been incorporated into the plans, policies and decisions of public agencies and industrial firms from the point of view of the interest group or alternatively from the perspective of the public agency or firm.

In summary, there are two overriding objectives of the questionnaires. The first is to determine whether and to what extent, if at all, the institutional and more importantly the public involvement problems discussed in Chapter 3 exist in the research area at the present time. These problems are generally associated with planning, policy formulation and decision making with respect to public land use decisions. Second, there is a need to determine the social preferences for extra-market goods of the groups involved in the Nelson Watershed land use conflict.

5.5 Education

In order to bring the interview participants to a reasonably consistant level of information on the Nelson Watershed conflict and resources, an educational process is used. This process involves four different types of information. The first uses a map folio to enhance visualization of the wide range[94] of characteristics of the Nelson Watershed. The folio includes a colour coded description of the Nelson Watershed in terms of its:

1. topography,
2. timber types,
3. recreation capability,
4. water and roads,
5. mining potential,

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[94]Maps available on request from the author.

6. ungulate capability,
7. waterfowl capability,
8. fish capability, and
9. soils capability.

The second part of the educational process uses a bar graph to provide information on the assumed nature and effect of disturbances in the Nelson Watershed. The bar graph (Figure 5.1) depicts the relative ordinal importance of nine different categories as they would be affected by reductions in watershed area allocated for harvest; the baseline being full watershed area allocated for harvest. An important assumption made in developing the graph is that the benefit (+,++) or cost (-,--) derived stems from withdrawal of timber that is slated to be cut. For example, if harvesting and road construction goes ahead in the watershed and water quality is reduced then benefit can be gained by excluding timber harvest from part of the watershed. The line bisecting the middle of the graph indicates the present situation regarding the proposed harvest of the watershed. If land in the watershed is withdrawn this change would effect the nine different categories in either an intangible or tangible way. This effect may be negative or positive. For example, withdrawal of watershed land would reduce the net present value of the harvestable timber crop from the firms viewpoint within a certain value range. Therefore, withdrawal has a tangible negative effect. On the other hand, by reducing the area available for timber harvest some sub-drainages would not be disturbed by road construction and harvesting activity. The quality of the water produced in these sub-drainages would thus be maintained at the existing level. In effect withdrawal has an intangible benefit through foregone development. Another important reason for developing the graph was that although harvesting might be excluded in a particular sub-drainage, the area does not immediately become designated for a single use, i.e., for water production and protection alone. The main reason for this condition being that landscape aesthetics and recreation uses would still be of importance in the watershed.

The third part of the educational process provides a brief socioeconomic profile of the City of Nelson and surrounding area. By carrying out this process those people interviewed are made more aware of the socioeconomic characteristics of the area and the role the forest resource plays in the area. The fourth part of the process is used to refresh the participants memory as to the major issues surrounding the Nelson Watershed conflict.

By providing the kinds of information described above, the information gap that sometimes exists at the outset of many conflicts among individuals, groups, public agencies and firms is reduced. More informed decision making may be the result.

5.6 Evaluation of Trade-offs

At the outset of the evaluation of watershed trade-offs, most of the major assumptions with respect to harvesting, costs, revenues, employment, etc., are described so that a clearer picture of how figures (e.g., net present value) are derived could be provided for the individual being interviewed. To reduce confusion on the part of those individuals asked to make land use choices, the number of scenarios and land use alternatives in each of the scenarios is kept to a minimum.

Figures 5.2 to 5.5 display in graphical fashion the ideas discussed in Chapter 4 on the development of an opportunity cost trade-off approach. Placing land use alternatives in a schedule employing a map that shows the alternatives, illustrates to the individual being interviewed the potential trade-offs between unpriced and priced goods in the short and intermediate-run. The intermediate-run is considered because of the element of individual time preference associated with resource developments. In two of the four scenarios the temporal element is incorporated by delaying the start of road construction and harvesting activity for a period of time. The interest in taking this approach is to determine if individuals developing land use plans, policies and decisions and those individuals directly affected by those plans, decisions and policies have neutral, positive or negative time preferences with respect to resource developments in their local area. Their responses might also give an indication of the

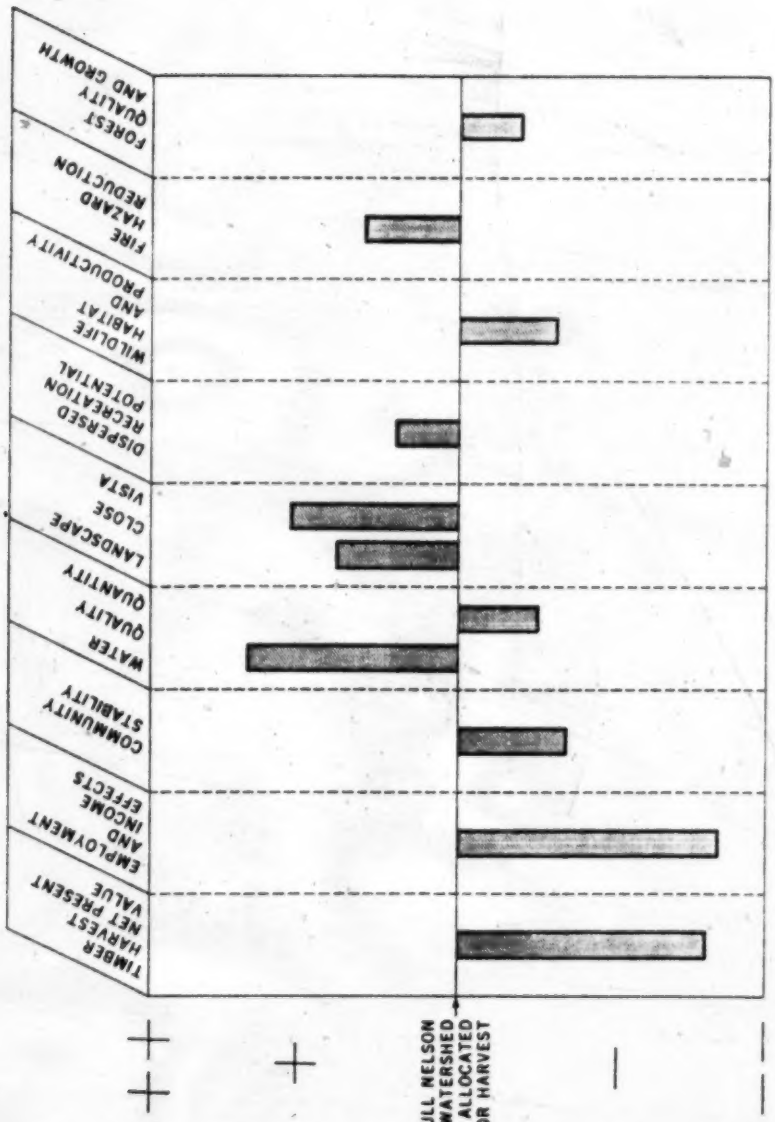

Figure 5.1 Ordinal Comparison of the Effects of Altering Watershed Area Allocated for Timber Harvest

emotional nature of the issues surrounding the Nelson Watershed land use plan.

After going over all the steps described above the interview participant is encouraged to ask any questions on points that were not clarified during the first part of the interview. The individual is then asked to make a choice of a preferred land use alternative for two of the four scenarios. Only two of four scenarios are chosen because depending upon the land use alternative chosen only one of the two road development alternatives is feasible. This process is developed to add greater flexibility and realism in terms of the choice made.

5.7 Conflict Identification

Given the deadlock in the conflict over the Nelson Watershed of importance here is the determination of the nature of the conflict and its participants. There are three important considerations in this regard: the first is the need to determine the extent of the difference in preferred land use alternatives between the public agencies, interest groups and firms; the second is the need to ascertain the opportunity cost of preferred land use allocations of the Nelson Watershed between the groups mentioned above; the third factor is that the cost of the Nelson Watershed public involvement program should be established. If the proposed interdisciplinary planning team for the Nelson Watershed is established and is assumed to function on a long-term basis, then some estimate may be made of the cost of running the public participation program. These considerations can be summarized as follows:

$$\text{Degree of Conflict} = AC - AP \qquad (5\text{-}1)$$

$$\text{Involvement Effectiveness} = AC - AP/CP \qquad (5\text{-}2)$$

$$\text{(Efficiency Gain)} = OPC/CRC$$

where

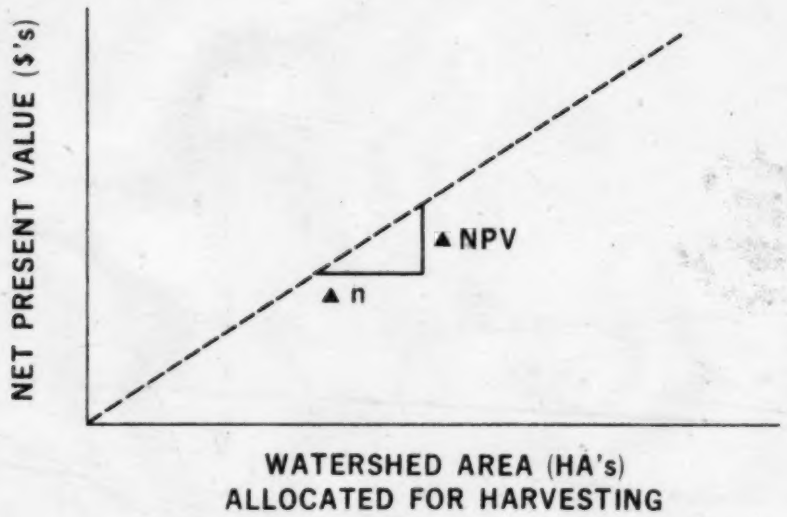

Figure 5.2 Net Present Value from Harvesting

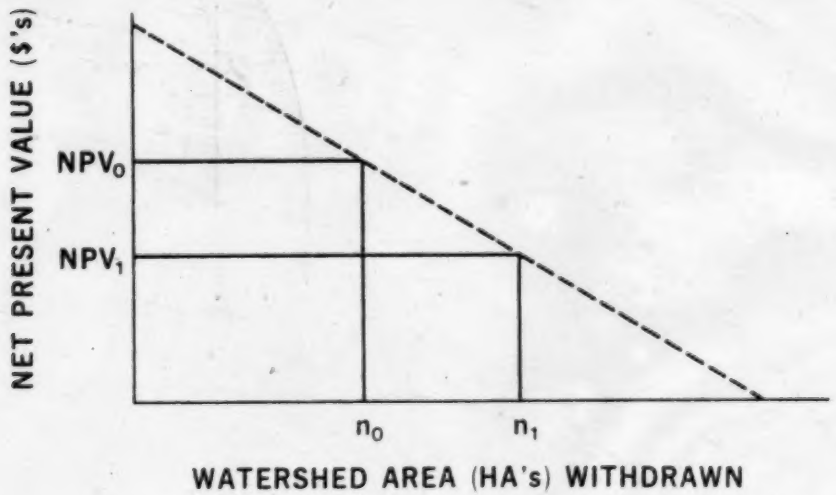

Figure 5.3 Opportunity Cost of Withdrawing Land Allocated for Timber Harvest

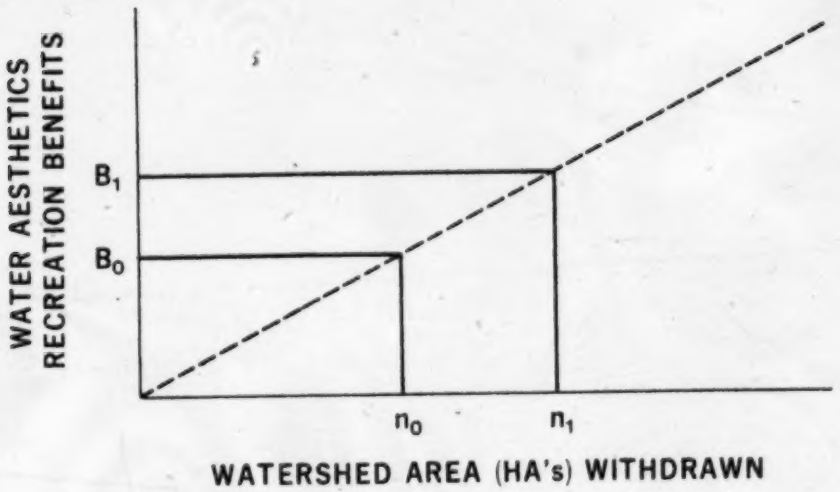

Figure 5.4 The Benefits Associated With Timber Land Withdrawn from Timber Harvest

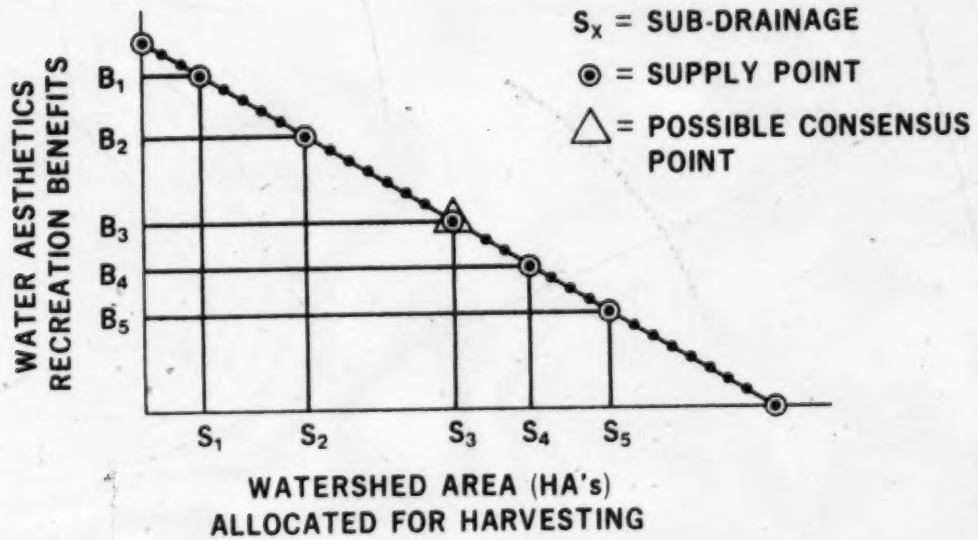

Figure 5.5 Benefits Associated With Supply Points Chosen by Groups or Public Agencies

AC = average opportunity cost accepted by the public and/or interest groups or by interest group representatives on a planning team

AP = average opportunity cost accepted by public agency personnel or by public agency personnel on a planning team

CP = cost of involvement program

OPC = opportunity cost of conflict

CRC = cost of resolving conflict

As the degree of conflict over a set of issues increases the difference in terms of opportunity cost between the groups involved will also increase and can be identified by equation 5-1. By introducing a consensus developing public involvement process a more efficient allocation of watershed resources may be derived. Consensus building thus has the potential to increase social net benefit which can be identified by equation 5-2.

Based upon the discussion above the average accepted opportunity cost of the Nelson Watershed land use alternative chosen by individuals representing one of the three groups (interest group, public agency and firm) is calculated. The calculation is complemented with the information obtained from the two questionnaires. The statistically derived average opportunity cost for each group is substituted into the formulae defined above. The formulae provide an estimate of the degree of group conflict and resource use efficiency gain possible if the planning team were to adopt the interest group land use choice.

6. Results and Analysis

6.1 Introduction

The results of the interviews undertaken in Nelson, B.C. during May 1982 are presented below. Those individuals interviewed represented either one of public agency, firm or interest group and in some cases, were also members of the Nelson Watershed Planning Team. In terms of resolution of the land use conflict over the Nelson Watershed, the planning team presently has primary input into decision making and decisions are arrived at by consensus. Eleven individuals were interviewed, they were members of:

1. Interest Groups
   a. N.A.W.C.
   b. M.S.W.U.
   c. Nelson Chamber of Commerce
   d. Nelson City Council
2. Public Agencies
   a. B.C.F.S.
   b. Water Rights Branch
   c. Selkirk Health Unit
   d. Regional District of Central Kootenay
3. Firm
   a. B.C. Timber (Kootenay Forest Products Division)

6.2 Average Opportunity Cost Results

The evaluation section of the interview supplied the results summarized in table 6.1. Each individual opportunity cost chosen for a scenario was averaged with others in a given group, e.g., public agencies, to arrive at an average opportunity cost per group. Table 6.2 shows the "involvement gain indicator" derived from equations 5-1 and 5-2. This gain is

Table 6.1 Average Opportunity Cost of Land Use Choices by Group and Scenario

Group	Form	Average Opportunity Cost (1982 $'s)			
		Scenario I	Scenario II	Scenario III	Scenario IV
Interest Groups	NPV	3 697 731.88	4 566 061.91	5 465 779.12	7 440 131.26
	NIE	3 809 033.79	3 373 279.03	5 807 617.03	7 328 496.98
	Total	7 606 765.67	7 939 340.94	11 273 396.15	14 768 628.24
Public Agencies	NPV	295 711.64	283 290.03	665 938.61	383 271.34
	NIE	469 829.91	364 069.66	607 323.59	499 873.19
	Total	765 541.55	647 359.69	1 273 262.20	883 144.53
Firm	NPV	0	0	0	0
	NIE	0	0	0	0
	Total	0	0	0	0
Public Agencies + Firm	NPV	253 467.12	242 820.02	570 804.52	328 518.29
	NIE	402 711.35	312 059.71	520 563.08	428 462.73
	Total	656 178.47	554 879.73	1 091 367.60	756 981.02

Note: NPV= Net Present Value and NIE= Net Income Effect

Table 6.2 Involvement Gain Indicator from Greater Public Involvement in Land Use Planning by Scenario

Scenario		Involvement Gain Indicator*
Scenario I	(A) Interest Groups - Public Agencies	273.65
	(B) Interest Groups - Public Agencies + Firm	278.02
Scenario II	(A)	291.68
	(B)	295.38
Scenario III	(A)	400.01
	(B)	407.28
Scenario IV	(A)	555.42
	(B)	560.47

*Note: A coefficient closer to zero indicates an improvement in efficiency conditions.
* Note: Example calculation for Scenarrio 1 (A)
7 606 765.67 - 765 541.55 / 25 000 = 273.65
Note: Values used in calculation above from Table 6.1
Note: The present annual public involvement budget for the Kootenay Lake T.S.A. is $25 000 and is assumed to remain constant through the harvest period.

calculated for each scenario.

Two different approaches (A and B) were used to determine the "involvement gain indicator" in Table 6.2. Approach A used the average opportunity costs of the interest groups and public agencies whereas in Approach B the average opportunity cost used is an average of the opportunity cost for interest groups and public agencies plus that of the firm.

6.3 Background Information Questionnaire (Individual) -Results

6.3.1 Respondent Characteristics

Respondent characteristics may be summarized as follows (Questions 1-9, see Appendix B):

1. The majority (83.3%) of individuals resided within the city limits of Nelson, while the remainder (16.7%) lived within a few miles of the city.
2. The average length of residence in the area differed greatly between the groups. The average for those individuals representing interest groups was 32 years, while for public agency and firm personnel the average was 12 years.
3. Eighty-three percent of individuals interviewed used piped city water, 8.5 percent used surface springs and 8.5 percent used wells.
4. In terms of age groups, individuals in interest groups and firm were all above 34 years, while 50 percent of the individuals in public agencies were less than 35 years old.
5. Of individuals in interest groups, 40 percent lived in a city, 40 percent lived in a rural area and 20 percent lived in a town during their youth. On the other hand individuals representing public agencies spent their youths mainly in the city. Fifty-seven percent lived in the city, while 29 percent lived in a town and 14 percent lived in a rural area.
6. Occupations of individuals in public agencies and firm were all professionally oriented. The occupations of individuals in interest groups varied. Fourty percent were professionals, 20 percent were self-employed and 40 percent had technical backgrounds.

7. The length of education of individuals in interest groups varied, the average post junoir-high (post-grade 9) education was 6.0 years. Education for the other two groups averaged 8.3 years.
8. Indoor and outdoor recreation activities varied for all three groups. The most popular outdoor activities were hiking, tennis and skiing (downhill and cross-country).
9. Individuals in all three groups were members of various professional and special interest organizations.

6.3.2 Respondent Concerns on Land Use

The list of concerns on land use related to the proposed development of the Nelson Watershed varied, for all interest groups taken together they were (Question 10 open-ended):

a. the maintenance of the present water quality and quantity;
b. the minimization of logging and road construction damage;
c. having the main haul road(s) closed to the general public;
d. the effect of not harvesting on employment and the surrounding community; and
e. preservation of the existing, relatively undisturbed, natural environment.

Public agency and firm concerns stated in the questionnaire (Question 10) are listed below:

a. the preservation of landscape aesthetics in the watershed;
b. that winter access for cross-country touring should be available;
c. the maintenance of the recreation quality of the watershed;
d. the maintenance of a high quality water supply;
e. interference with the present operation and future expansion of the Whitewater Recreation Area;
f. the management and preservation of productive forest land for sustained yield timber production;
g. the development of a working relationship between professional foresters, the general

public and other government agencies;

h. that sound forest management practices be applied to the Nelson Watershed on a multiple-use basis;

i. that the productive forest land base of the Nelson Watershed is managed to provide the maximum amount of social and economic benefits;

j. the integrity of the watershed must be maintained, i.e., suitable water quality and quantity must be provided;

k. the economic base of the area would be jeopardized by excluding timber harvesting from the watershed; and

l. the public must be informed about the implications of government policies and firm plans in terms of forested land in general and the harvest of watersheds in particular.

A list of the responses by individuals representing interest groups to the question of how they thought the majority of the general public wanted the watershed used (Question 11) were:

a. that it should remain as it is and only selectively log on a small area;

b. that it should be developed with caution under strict guidelines;

c. that there should only be limited recreation in the watershed and the main haul road should be gated and guarded, if logging were to be permitted; and

d. that there should be no development of the watershed whatsoever, the people like the water without treatment.

Public agency and firm personnel responses were varied (Question 11). They are listed below:

a. that there should be integrated use of the forest and water resources, use of other resources should be restricted;

b. that the vast majority do not care as long as the water quality and quantity is maintained;

c. the visual effect of logging and roads on the volume of local tourist traffic;

d. that the timber values of the watershed must be realized so that jobs are not lost in local mills but not at the expense of the water supply;

e. that the watershed should be preserved, there should be no timber development to maintain water and aesthetic resource values; there are plenty of other watersheds that could be developed; and

f. that a form of multiple-use should be instituted in the watershed.

A list of the preferred watershed use for all the interest groups (Question 12) is given below:

a. selective logging only;

b. water production with no logging whatsoever;

c. water production and other uses compatible with the water resource; and

d. water production only and minimal access by logging companies if deemed essential.

Public agency and firm personnel responded (Question 12) that there should be:

a. carefully controlled logging to increase or maintain present levels of employment and to increase the recreation potential in the area;

b. a mixed use approach should be used, i.e., protect the water quality without excluding timber harvest and recreation activities;

c. recognize water as the primary resource in the watershed, therefore, logging should be undertaken only under very strict guidelines;

d. controlled harvesting spread over the watershed and temporally to lessen the impact; there should be direct involvement of those affected including technical expertise; and

e. develop the watershed for all uses, with the primary use identified as domestic water production.

The most socially beneficial land use for the watershed by interest group representatives (Question 13) are:

a. water production;

b. preservation of water quality and quantity; and

c. water production with minimal logging activity.

Public agency and firm personnel responses (Question 13) are listed below:

a. that recreation use should be limited in some way to minimize the hazard of water contamination;

b. that it should be water production alone;

c. that there should be intensive management of the forest land base to produce the most for least, while protecting the water supply;

d. that there should be an attempt by the city to upgrade its waterworks to withstand minimum artificial and most natural disturbances; and

e. that there should be continued soil and access corridor studies, the new Timber Supply Area Yield Apportionment puts increased emphasis and pressures on the Nelson Watershed as a timber supply for the Nelson mill.

6.4 Background Information Questionnaire (Group) -Results

6.4.1 Background-Interest Groups

The background to interest groups was provided in response to Question 2(a-f). There were three interest groups involved in the conflict over the use of the Nelson Watershed, the Nelson City Council (7 members) which represented the city and resident interests, the Nelson and Area Watershed Committee, and the Mountain Station Water Users. The N.A.W.C. had a fluctuating membership of between 25 to 50 individuals. The third group, the Mountain Station Water Users, had a membership of 16 individuals. A few other interest groups, i.e., S.P.E.C. and B.C. Naturalists, expressed initial concern over the development plan but dropped out as the conflict escalated and the other interest groups formed.

The N.A.W.C. has been in formal existence since October of 1980, and the M.S.W.U. since January of 1981. The M.S.W.U. has met monthly since its establishment and the N.A.W.C. met monthly until the summer of 1981. An impasse over the development of the

watershed was reached at that time with the Ministry of Forests. Since that time only a N.A.W.C. steering committee has met on an irregular basis. The meeting format for the groups varied. The N.A.W.C. meetings were open to the public and were conducted formally. A consensus was necessary to make final decisions. The steering committee met informally and the meetings were closed to the public. Generally, the meetings of the M.S.W.U. were run informally.

The N.A.W.C. was formed as a result of a Ministry of Forests sponsored meeting, run by Dr. B. Fraser, to discuss projected logging in the watershed. This meeting stimulated the establishment of the group sponsored by the Ministry of Forests. The M.S.W.U. was also sponsored by the Ministry of Forests but the main reason for its formation was concern over the proposed logging road location above their springs and wells.

The chief aims or goals of the N.A.W.C. and M.S.W.U. were:

1. to learn as much as possible about proposed logging operations in the watershed;
2. to make recommendations, based upon the information gained in (1.) above, to the city and surrounding residents;
3. to take part in the planning of the project;
4. to monitor all planning and operations;
5. to determine the proper location of the logging road in the watershed; and
6. to protect the water supply produced in the watershed.

The Nelson City Council was mainly concerned about the cost of developing an alternative water supply and of upgrading an aging waterworks system. Council members felt that the city had legal rights to the water produced in the watershed.

In terms of group input (Question 2(g-h)), the M.S.W.U. representative felt that it was only infrequently listened to by public agencies when the agencies formed policies or made operational decisions; also the representative felt that the groups input was infrequently effective in changing public agency policies and operational decisions with respect to the Nelson Watershed. On the other hand, the N.A.W.C. representative felt that the groups input was

frequently listened to by public agency personnel when they developed land use policies and operational decisions related to the watershed. However, it was felt that the groups input was only infrequently effective in altering public agency policies and operational decisions. At the present stage in the conflict all of the interest group representatives reported that there were no examples of incorporation of their input relating to the proposed development of the watershed by the public agencies concerned.

Generally, the groups dealt (Question 2(i)) with the Ministry of Forests, Water Rights Branch, Water Investigations Branch, Environment and Land Use Secretariat and the Waste Management Branch. Occasional contact was also made with the local Health Unit and Ministry of Energy, Mines and Petroleum Resources.

The representative of the N.A.W.C. expressed a feeling that the members of his group would want the watershed used for water production with tightly controlled logging, access should be minimized and preferably remain as a source of water only. The latter point was echoed by the M.S.W.U. representative as the way the group would want the watershed used.

6.4.2 Background to Public Agencies and Firm

The results of Question 3(c-e) indicated that there is communication or interaction between public agency, firm and interest groups from the viewpoint of the public agency and firm personnel. Thirty-eight percent stated that the communication occurred on a daily basis, 26 percent on a weekly basis and 12 percent on a monthly, yearly or as needed basis. The form of contact was found to be varied and many agencies used a number of means to interact with interest groups. The most commonly used methods of communication were informal meetings and telephone conversations. Public hearings and personal correspondence were the next most frequently used. Formal meetings were used the least.

Public agency and firm personnel felt (Question 3(f)) that the group they represented frequently and occaisionally infrequently listened to interest group input when policy was formulated. Nevertheless, there was an equal split between frequently and infrequently in terms

of their agency listening to interest group input when making operational decisions. There was a similar split over the question of how well the agency or firm responded to interest group input by incorporating it into policy form. On the other hand, the majority of those individuals interviewed responded that their agency or firm frequently reacted to interest group input by attempting to incorporate it into operational decisions. The remainder felt that this attempt at incorporation did not occur.

There were at least one or two examples given (Question 3(g-i)) by agency or firm representatives interviewed that indicated their group incorporated interest group input into decisions and policies or it significantly affected them. Thirty-eight percent of the interviewed individuals felt their agency or firm policies or mandates directly allowed for the inclusion of interest group aims into policies and decisions that were developed. Thirty-eight percent stated that their were policies or mandates to indirectly incorporate interest group input and twenty-four percent said none existed at all. All those responding in the affirmative believed that the option to allow public involvement was politically motivated.

7. Discussion, Conclusions and Recommendations

7.1 Introduction

In this final chapter results are discussed, some conclusions drawn based on the results and some brief recommendations made toward future avenues of work. The discussion focuses on the differences in opportunity cost arising from the evaluation step of the interview. Bases for these differences are found from examination of the questionnaire results.

7.2 Discussion of the Results

The opportunity cost and questionnaire results presented in the previous chapter provide some insight into the reasons for the land use conflict over the use of resources in the Nelson Watershed. There is an indication that wide differences in land use preferences exist between the three groups involved. The extent of these differences or the degree of conflict can bee seen by examining Table 6.1. Average opportunity cost in the four scenarios for interest groups is considerably larger than for the other groups. This difference indicates that the minimum value or critical value of the water and amenity resources in the watershed is much higher for the interest groups than for the firm and public agencies. The significance of this result is the relative difference in size of opportunity cost between the groups, where the opportunity cost for the public agencies and firm are closer as compared to the interest groups. A preference for a timber based land use for the watershed may be seen in the low opportunity cost chosen by the public agency group and firm. The value of the water and amenity resources in the watershed *vis a vis* timber is much lower.

An attempt was made to determine whether or not the value of the respective resources examined in the study changed over time, i.e., whether or not implementation of the harvest plan was delayed for five years, and in what direction. A comparison of scenarios 1 and 2 and scenarios 3 and 4 by group shows that there is a change in the average opportunity cost over time. Interest group opportunity cost rises by 4.4 percent for Scenarios 1 and 2 and by 31.0

percent for Scenarios 3 and 4. Public agency opportunity cost declines by 15.0 percent for Scenarios 1 and 2 and by 31.0 percent for Scenarios 3 and 4. Firm opportunity cost at zero does not change over time.

The direction of change suggests that public agency and firm personnel value present use over future resource use, and that interest groups will accept a larger opportunity cost in the present to obtain a preferred form of land use in the future. Firm opportunity cost is zero in all cases which is a strong indicator of the high value placed on the watershed timber as opposed to water and amenity. The importance of the water and amenity resources to interest groups, the importance of timber to the firm in the short- and intermediate-run as an unsubstitutable input of production, and the importance of the timber, water and amenity to the public agencies as sources of employment, revenue and various intangible benefits are all illustrated to some degree in Table 6.1.

The results of the questionnaires provide some insight into why the objective (land use) differences occur. The objectives of the groups involved were mentioned previously. Differences in these objectives and the methods used to reach them, if focused upon a particular set of issues, tend to result in the development of conflict. These differences are a function of individual physical, social, and economic characteristics. Group characteristics of a similar nature also have an impact on the differences that arise. Constraints of an institutional nature impact on individuals, groups, public agencies, and firms as well. The sources of the differences are easy to describe in a general way but are difficult to specify because of the complexity of the parameters involved. The questionnaires were used to better define some of the more general causal factors that influence the choice of land use pattern by groups and individuals.

7.2.1 Participant Survey

Two main points fall out of the participant survey results that have some bearing on the objective differences. First, there was a significant difference in the average ages of the

individuals involved. The individuals representing interest groups were generally older than those in public agencies. Furthermore, the length of residence in the Nelson Watershed area of those individuals representing interest groups was almost three times that of the public agencies and firm personnel. The second point of interest is related to the environment (city, town, or rural area) in which the individuals lived in during their youths. Sixty percent of individuals in interest groups spent their youth in a mainly rural setting compared to forty-three percent of public agency representatives. Educational levels were similar although the public agency personnel tended to have slightly more than two years post junior-high level education than interest group members.

The age difference, education level, length of residence and the kind of area spent during youth all have a varied influence on those involved in terms of the land use that is preferred. It is impossible to say, without further study, exactly how these factors influence those individuals. Perhaps, of most importance here are the significant differences in the characteristics and background of the individuals involved. These differences may contribute to the degree of the land use conflict and to the length of time it persists.

The issues that polarized the different groups have been listed in the previous chapter. However, there is some use at this point in the discussion in pinpointing the main theme of each group to better understand their stated objectives. The interest groups see the maintenance of the existing form of land use as the preferred land use choice. If timber harvest were to proceed as proposed then strict guidelines must be enforced to ensure the existing quantity and quality of the water supply and amenity resources. The interest groups also realized that the choice they were making would have spinoff effects on other areas and individuals other than whom they represented. However, their responses to how they thought the majority wanted the watershed used were quite similar to their own preferences.

The main problem and reason for land use conflict was that the interest groups views were split over whether or not their input was having an effect on policy formulation, planning and operational decisions in general and specifically on the Nelson Watershed proposal.

Nevertheless, the groups agreed that the input was rarely effective in altering previously formed decisions or plans, and would be the same for the Nelson Watershed proposal. The general feeling prior to the development of the planning team was that the involvement process was one of tokenism and not consultive in nature as suggested by the B.C.F.S. At the present stage in the conflict all of the interest group representatives felt that they were ignored insofar as final decision making was concerned.

Public agency concerns were more varied mainly because of the array of mandates and responsibilities that constrained them. Nonetheless, they did express the wide range of constraints that impinge on public agency personnel in dealing with interest groups, the general public, and the private sector, and that it is difficult for public agencies to resolve resource use conflicts because of these institutional barriers. Some agencies were more or less in agreement with the interest groups over timber development but felt that it could only commence if sufficient precautions were taken. The B.C.F.S., of all the public agencies, was the most constrained by its mandate and yet most involved in the conflict. The B.C.F.S. had to resolve the conflict of using the forest resource for the direct and indirect benefit of British Columbians concurrent with minimizing the cost to interest groups by so doing. Firm concerns were mainly with the security of tenure and the supply of timber in the watershed.[35] Public agency and firm responses to the land use alternative they thought the public wanted again reflected a broad range. They differed little from their own notion of alternatives although, greater consideration of amenity and water resources was evident. The public agencies and firm involved indicated that water and timber production were the primary resources for use in the Nelson Watershed.

The problem most evident was that the public involvement mechanism in place through the development of the land use conflict was inadequate and inappropriately used. Therefore, even though some flexibility existed in the relative positions adopted by the groups involved, the involvement mechanism did not aid in resolving, or reducing, the degree of conflict. An

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[35]Presently (mid 1983) the Nelson B.C. Timber mill is operating but is only producing small quantities of lumber; efforts to sell the mill have occurred recently.

opportunity for an efficiency gain in resource use was therefore lost.

Public agency personnel regularly communicated with interest groups on a very informal basis. This form of public involvement was generally felt to be sufficient to deal with minor conflicts over resource use prior to the Nelson Watershed proposal. In addition to the above, agency personnel felt that they listened to the input from interest groups and modified their decisions policies, or plans accordingly. Some agency personnel felt that this involvement and flexibility did not occur often.

In general, the major problem surrounding the Nelson Watershed and resulting conflict are as follows:

1. the emotional nature of the issues involved;
2. the constraining mandates (e.g., majority versus minority groups) of public agencies;
3. the difficulty of determining trade-offs between priced (timber) and non-priced (water and amenity) goods; and
4. the existance of a consultive public involvement mechanism that is unsuited or insufficiently flexible to deal with major localized land use conflicts.

7.3 Conclusion

The issues listed and the statements of the 'best' form of land use by each group show that there are substantial differences in opinion between the groups involved in the conflict. The author feels that these differences form the basis of the opportunity cost difference. Thus, opportunity cost may be used to measure issue differences. Opportunity cost also identifies the extent of conflict and the potential for gain from public involvement of the appropriate type. A trade-off mechanism can be developed that uses the opportunity cost values derived as critical values. The values can then be used in the public involvement process to illustrate the potential cost or benefit of a particular land use decision. Judgement then is necessary to determine if the value of the water and amenity resources is greater than the critical (opportunity cost) value of foregoing timber harvest of a particular spatial and temporal type.

In this study the intangible values of water and amenity have been defined as being equal to the opportunity cost of foregoing timber harvest. Although the differences in Table 6.1 are not statistically analytical (small sample size), they do indicate that wide differences in land use preference do exist between groups. Hence, they do identify the degree of conflict (X million dollars). Therefore, a need for discussion through public involvement is indicated. Reduction in the degree of conflict has the potential to lead to an efficiency gain in the allocation and use of resources in the Nelson Watershed.

Nevertheless, public involvement can only achieve so much in terms of isssue identification as through the questionnaires. The planning team has progressed to a similar point as well. What is needed and is developed in this study is means of quantifying conflict that has the potential for the mis-allocation of resources and *a priori* reducing social net benefit. Quantification of conflict leads to a Pareto-improvement (see Table 6.2) by allowing decision makers and other individuals involved in conflict to attach a pecuniary value to the Nelson Watershed intangibles (minimum critical value). A better understanding of the nature of the trade-offs involved in any decision, plan, or policy development involving the trade-off of market and non-market goods is then possible. Two main observations can be made based on the results found in Table 6.1. First, the average opportunity cost accepted by the three main groups varies widely. The ranking is the same for each scenario: INTEREST GROUPS (e.g., Scenario 1-$7.6 million)> PUBLIC AGENCIES ($0.77 million)> PUBLIC AGENCIES+FIRM ($0.66 million)> FIRM ($0.0 million). Second, public agency and firm personnel value present resource use (timber harvest) patterns more highly than future use patterns; also, interest groups will accept a larger opportunity cost in the present to obtain a delay in the proposed watershed development. These differences provide an indication of the widely differing perspectives and constraints, both individual, group, and institutional that exist, and how difficult it is to move towards efficient and equitable resource use. The benefits of public involvement are to find a harvest plan which recognizes, through the use of opportunity cost, the differences in group preferences.

7.4 Recommendations

There are a number of interesting problems that were not possible to deal with given the scope of the study and the complexity of the of the subject investigated. Much of the discussion indicates support by the author for citizen or public participation and revealed preference in market/non-market goods trade-off situations. However, this support is diminished by looking only at select group representatives. Measurement of the spatial and temporal preferences of the general public and other interest groups for various land use alternatives in the Nelson Watershed is necessary to further refine the study and resolve this problem. Further research to resolve this problem might take the form of expansion in the scope of the questionnaires. A large number of questionnaires could be sent out randomly to individuals living in the affected area to determine how they would like to see the area developed. In addition to this approach, questionnaires could be sent out to individuals in concerned interest groups, public agencies and firms to determine their preferences for the use of the Nelson Watershed. The collection and use of this information would improve the knowledge and planning of the individuals on the planning team and consequently the social net benefit derived from the use of the timber, amenity and water resources of the watershed. Questionnaires could also be sent out periodically to reassess the preferences of the general public and citizen representative groups to see if there had been any change in their preferences concerning the short-and intermediate-run use of the watersheds resources. However, this would be a costly means of obtaining public input and may reduce the overall efficiency gain derived by the use of that particular form of public involvement mechanism. Some effort might be made as the planning process continues to utilize a questionnaire to determine public and interest group preferences for land use and/or for proposed land use plan alternatives developed by the planning team.

Another limitation in the study is the use of only one real discount rate (5%) to determine the opportunity cost values. A sensitivity analysis that uses a range of real discount rates to derive land alternative values for the opportunity cost schedules might also be

developed. The sensitivity analysis would allow individuals and groups to observe and choose between a greater array alternatives than those developed in the study. A more sophisticated econometric model that determines prices for various forest products would also provide an increased degree of reliability in the prices used to calculate opportunity cost.

A methodology similar to the one used in the study could be used as a tool to assist in the resolution of other local or regional forms of land use conflict. For example, the Province of Alberta is presently entering a phase in the use of its timber resource where Timber Development Areas are proposed that would commit the remaining forest reserve to timber production. The existing state of land use planning and public involvement in the province should be examined so that the increasingly complex economic, social, and environmental issues and conflict that will likely arise out this development may be dealt with effectively. Alberta presently has surplus economically available timber relative to the rest of Canada. However, this condition also puts the province in the unenviable position of having to deal with the pressure to develop the timber resource at the expense of other less tangibly valued resources mentioned in the study.

Well developed and thought-out forms of 'open' land use planning and public involvement need to be devised to assist in the reduction of land use conflicts over natural resources in Canada. A policy recommendation based on consideration of these issues is for involvement to use opportunity costs of timber to aid in the movement towards a more efficient allocation of resources.

Bibliography

Abrahamsson, B., *Bureaucracy or Participation*, (Beverly Hills, Calif.: Sage Publications Incorporated, 1977).

Apsey, F.W., "Resource Management in British Columbia," in *Integrated Management of Resources*, Proceedings of a conference Nov. 2-4. 1978, Vancouver, Resources Industries Programmes Centre for Continuing Education, U.B.C.

Arnstein, S.R., "A Ladder of Citizen Participation," *Journal of the American Institute of Planners*, 35 (1969), 216-224.

Barbour, I.G.(ed.), *Western Man and Environmental Ethics*, (Reading, Mass.: Addison-Wesley Publishing Company, 1973).

Bator, F.M., "The Anatomy of Market Failure," *Quarterly Journal of Economics*, 72 3 (1958), 51-79.

Boadway, R.W., *Public Sector Economics*, (Cambridge, Mass.: Winthrop Publishers, Incorporated, 1979).

British Columbia Ministry of Forests, *Kootenay Lake Timber Supply Area Yield Analysis*, (1980).

British Columbia Ministry of Forests, *An Inventory of the Wildland Recreation Resources of the Kootney Lake T.S.A.*, (1979).

British Columbia Ministry of Forests, *Forest and Range Resources Analysis Technical Report*, (1980).

Byron, R.N., "Community Stability and Forest Policy in British Columbia," *Canadian Journal of Forestry Research*, 8 (1978), 61-66.

Carroll, M.R., *The Multiple Use of Woodlands*, Occasional Paper No. 10. (Cambridge: University of Cambridge, Department of Land Economy, 1978).

Carroll, M.R., *Conservation Values*, Unpublished Manuscript (Edmonton, Alta.: The University of Alberta, Department of Rural Economy, 1982).

Ciriacy-Wantrup, S.V., "National Resources in Economic Growth: The Role of Institutions and Policies," *American Journal of Agricultural Economics*, 51 (1969), 1319.

Ciriacy-Wantrup, S.V. and R.C. Bishop, "Common Property as a Concept in Natural Resources Policy," *Natural Resources Journal*, 15 (1975), 712-727.

Clawson, M., and J.L. Knetsch, *Economics of Outdoor Recreation*, (Baltimore: The Johns Hopkins University Press, 1966).

Connor, D.M., *Citizens Participate*, (Oakville, Ont.: Development Press, 1974).

Connor, D.M., "Models and Techniques of Citizen Participation," in B. Sadler (ed.), *Involvement and Environment*, Vol. 1. (Edmonton: Environment Council of Alberta, 1977).

Dasgupta, A.K., and D.W. Pearce, *Cost-Benefit Analysis: Theory and Practice*, 2nd ed., (London: The MacMillan Press Limited, 1980).

Downs, A., *Inside Bureaucracy* (Boston: Little, Brown and Company, 1967).

Fraser, B., J. Baron and D. Ailman, *B.C.F.S. - Selkirk College Report on Public Involvement and Resource Use in Planning Units 4 and 5 the Nelson Watershed*, (Castlegar, B.C.: Selkrik College, 1977).

Gibson, R.B., "The Value of Participation," *in Environmental Management and Public Participation*, P.S. Elder (ed.), The Canadian Environmental Law Research Foundation and The Canadian Environmental Law Association, (1975).

Hardin, G. and J. Baden (ed.'s), *Managing the Commons*, (San Francisco: W.H. Freeman and Company, 1977).

Howe, C.W., *Natural Resource Economics*, (Toronto: John Wiley and Sons, 1979).

Phillips, W.E. and D. DePape, *The Role of Economics in Shorelands Evaluation*, I.M.P.A.C.T. Environomics Ltd. for Alberta Environment, (Edmonton, Alta., 1976).

Krajina, V.J. and T. Carson, *Ecological Reserves in British Columbia*, (Victoria, B.C.: Ecological Reserves Unit, Ministry of Environment, 1978).

Krutilla, J.V., "Conservation Reconsidered," *American Economic Review*, 57 (1967) 777-786.

Krutilla, J.V. and C.J. Cicchetti, "Evaluating Benefits of Environmental Resources with Special Application to the Hells Canyon," *Natural Resources Journal*, 12 1 (1972), 1-29.

Krutilla, J.V. and A.C. Fisher, *The Economics of Natural Environments: Studies in the Valuation of Commodity and Amenity Resources*, (Baltimore: Johns Hopkins University Press, 1975).

Lauer, S., "An Economic Profile of the Regional District of Central Kootenay," *Regional District of Central Kootenay*, (1982).

Lipsey, R.G., G.R. Sparks and P.O. Steiner, *Economics*, 2nd ed., (New York: Harper and Row, 1976).

Lucas, A.R., "Legal Foundations for Public Participation in Environmental Decision Making," *Natural Resources Journal*, 16 1 (1976).

McAllister, D.M., *Evaluation in Environmental Planning: Assessing Environmental, Social, Economic and Political Tradeoffs*, (Cambridge, Mass.: MIT Press, 1980).

McKillop, W., and W.J. Mead (ed.'s), *Timber Policy Issues in British Columbia*, (Vancouver: University of British Columbia Press, 1976).

Morley, C.G., " The Legal Framework for Public Participation in Canadian Water Management," in *Environmental Management and Public Participation*, P.S. Elder (ed.), The Canadian Environmental Law Research Foundation and The Canadian Environmental Law Association, (1975).

Musgrave, R.A., *The Theory of Public Finance*, (New York: McGraw-Hill, 1959).

Ogle, R.A., "Institutional Factors to Encourage Interagency Cooperation in the Management of Natural Resources," *Public Administration Review*, 32 (1972).

Ophuls, W., *Ecology and the Politics of Scarcity*, (San Francisco: W.H. Freeman and Company, 1977).

O'Riordan, T., "The Public Involvement Program in the Okanogan Basin: A Study," *Natural Resources Journal*, 16 1 (1976).

O'Riordan, T., *Environmentalism*, (London, England: Pion Limited, 1976).

O'Riordon, T., "Policy Making and Environmental Management: Some Thoughts On Processes and Research Issues," *Natural Resources Journal*, 16 1 (1976), 55-72.

Phillips, W.E., D. DePape, M.R. Carroll, L.P. Apedaile, and T.S. Veeman, *The Role of Socioeconomic Evaluation in Timber Development Proposals in Alberta - Final Report*, (Edmonton, Alta.: I.M.P.A.C.T. Environomics, 1981).

Province of British Columbia, *Forest Act*, (1978), Section 4.

Randall, A., *Resource Economics: An Economic Approach to Natural Resource and Environmental Policy*, (Columbus, Ohio.: Grid Publishing Inc., 1981).

Randall, A., "The Problem of Market Failure," *Natural Resources Journal*, 23 (1982), 131-148.

Reed, F.L.C., and Associates Ltd., *Forest Management in Canada: Volume I*, Fish. Envir. Can. Can. For. Ser. For. Manag. Inst. Inf. Rep. FMR-X-102 (1978).

Sadler, B., "Basic Issues in Public Participation: A Background Perspective," *Involvement and Environment*, Proceedings of the Canadian Conferences on Public Participation, Vol. 1. (Edmonton: Environment Council of Alberta, 1977).

Samuelson, P.A., "Pure Theory of Public Expenditures," *Review of Economics and Statistics*, 36 (1954), 387-389.

Samuelson, P.A., "Diagramatic Exposition of a Theory of Public Expenditure," *Review of Economics and Statistics*, 37 (1955), 350-356.

Schmid, A.A, "Analytical Institutional Economics: Challenging Problems in the Economics of Resources for a New Environment," *American Journal of Agricultural Economics*, 54 (1972), 893.

Schmid, A.A., *Property, Power and Public Choice: An Inquiry into Law and Economics*, (New York: Praeger, 1978).

Sewell, W.R.D. and T. O'Riordan, "The Culture of Participation in Environmental Decision Making," *Natural Resources Journal*, 16 1 (1976), 10.

Sewell, W.R.D. and S.D. Phillips, "Models for the Evaluation of Public Participation Programs," *Natural Resources Journal*, 19 2 (1979), 338-358.

Siden, J.A. and A.C. Worrell, *Unpriced Values: Decisions Without Market Prices*, (Toronto: John Wiley and Sons, Incorporated, 1979).

Symposium on Public Participation in Resource Decisionmaking, *Natural Resources Journal*, 16 1 (1976).

Wengert, N., "Citizen Participation: Practice in Search of a Theory," *Natural Resources Journal*, 16 1 (1976), 23.

Wolf, C. Jr., "A Theory of Nonmarket Failure: Framework for Implementation Analysis," *The Journal of Law and Economics*, 22 1 (1979), 107-139

Appendix A

Table A.1 Nelson Forest Region N.S.R. Forest Land by Site Class (ha.)

Forest Cover Type	Site Class				Total
	Good	Medium	Poor	Low	
N.S.R					
P.S.Y.U.'s	9942	95807	63294	2948	171991
T.F.L.'s	1550	6861	1631	-	10042
Recently Disturbed					
P.S.Y.U.'s	6172	34410	6105	10	46697
T.F.L.'s Brush	3041	8805	1251	-	13097
P.S.Y.U.'s	174	754	12790	560	20578
T.F.L.'s	64	322	15	-	401
Totals					
P.S.Y.U.'s	16288	137271	82189	3518	239266
T.F.L.'s	4655	15988	2897	-	23540
Grand Totals	20943	153259	85086	3518	262806

Source: B.C. Ministry of Forests, Forest and Range Resources Analysis Technical Report, 1980, p. 465.

Table A.2 Nelson Forest Region Forest Industry Activity

Item	1960	1964	1968	1972	1976	1977
Log Production('000 m^3)	2935	4520	5925	6416	5917	6661
Lumber Production(MMFBM)	622	958	1255	1359	1254	1411
Number of Sawmills Operating	268	204	159	97	130	119
Veneer Mills	1	1	3	3	4	4
Plywood Mills	-	-	1	2	2	2

Source : Ibid., p. 467.

Table A.3 Nelson Forest Region Existing Ecological Reserves

Name of Location	Ecological Reserve Number	Size (ha.'s)
Mount Sabine	19	7.9
Columbia Lake	20	32.4
Ram Creek	26	121.4
Lew Cr.-Mount Hadow	31	815.0
Evans Lk.-Valhalla Range	32	185.4
Goosegrass Cr. Drainage Basin	56	2185.4
Total	6	3347.5

Source : Krajina, V.J. and T. Carson, Ecological Reserves in British Columbia, (2nd ed.) (Victoria, B.C.: Ecological Reserves Unit, Ministry of the Environment, 1978), various pages.

Table A.4 Nelson Forest Region Utilization of Wildlife

	Estimated Hunting	Effort (days)	Value Per Hunter day($'s)
Species	1979	1985	1979
Elk	49218	65000	27.65
Bighorn sheep	1737	2500	42.73
Mountain goat	600	1000	22.26
Grizzly bear	1896	1750	23.85
Moose	17319	22500	31.57
Cougar	1100	1100	9.15
Deer	68806	70000	18.45
Caribou	52	50	33.71
Upland game birds	20000	25000	9.15
Black bear	11200	15000	9.15
Waterfowl	10000	10000	10.56

Source : Ministry of Forests Technical Report, p. 484.

Table A.5 Nelson Forest Region Distribution of Water Districts

Water District	Number of Watersheds	Drainage Area(sq. km.)
Cranbrook	6	2240
Fernie	3	90
Golden	9	170
Grand Forkes	5	500
Kaslo	5	460
Nelson	59	1690
Revelstoke	6	120
Total	93	5270

Source : Ministry of Forests Technical Report, p. 486.

Table A.6 Water Resources Use Information for the Nelson Area

Source	Licences	Domestic ***	Wwks ***	Irrig. ****	Land Impmt ***	Demand ***	Av.Low Flow ***
Five Mile Cr.	1	–	1615 400	–	–	3.0**	5.3**
Anderson Cr.	6	1000	1500 000	8.2	–	2.8**	0.5**
Selous Cr.	2	500	1000 000	1.9	–	1.9**	1.0**
Apex Cr.	2	10000	3000 000	–	500000	6.5**	6.0**
Clearwater Cr.	2	–	5250 000	–	500000	10.7**	9.0**
Hermitage Cr.	1	500	–	3.0	–	7300	800000
Laben Cr.	4	2500	–	–	–	2500	3000
Hume Cr.	6	2500	–	12.5	–	30800	*
Tank Cr.	5	2500	–	4.5	–	12700	21600
Word Cr.	14	8000	–	3.2	–	15200	40000
Kasper Br.	1	500	–	–	–	500	3500
Rumbling Cr.	2	1000	–	25.0	–	57600	*
Salmo Riv.	1	500	–	–	–	500	350000
Dempsey Sp.	3	1500	–	–	–	1500	1600
Hall Sp.	1	500	–	–	–	500	*
Anna Sp.	1	500	–	–	–	500	500
Rixey Sp.	2	1000	–	–	–	1000	*
Wilson & Rutledge Sp.'s	1	500	–	–	–	500	*
Innes Sp.	3	1500	–	–	–	1500	*
Andreed Sp.	1	500	–	–	–	500	2900
Porteous Sp.	1	–	–	0.5	–	1100	5000
Cherryash Sp.	1	500	–	–	–	500	10800
Nachbaur Sp.	1	1000	–	1.3	–	4000	37500
CottonWood Cr.	6	1500	5385000	23.8	–	1.1**	1.5**
Anno Cr.	1	500	–	0.8	–	2300	*
Thompson Sp.	2	500	–	1.3	–	3400	4800
Camaro Cr.	1	500	–	1.3	–	2900	*
Maglio Cr.	1	–	–	2.0	–	4500	*
Orlich Sp.	1	250	–	–	–	250	50
Mawer Sp.	2	1000	–	–	–	1000	3200
Postle Sp.	2	500	–	0.2	–	1000	*

Source :Selkirk College Report on Public Involvement and Resource Use in Planning Units 4 and 5 - the Nelson Watershed p.46. *No Record** Cubic Feet Per Second *** Gallons Per Day **** Acre Feet Note : Wwks=Waterworks, Impmt=Improvement

Appendix B

Purposes for Public Participation from Resource Agency Perspective

1. To ensure that the public interest is served by a resource development proposal and to document that service.
2. To corroborate, legitimize, and even build support for internally developed positions about local preferences and relationships.
3. To minimize future operational costs.
4. To minimize conflict and manage potential discontent.
5. To minimize public intervention.

General Perspective Purposes

1. To ensure accountability for the public interest on the part of government.
2. To develop a clear expression of what the public preferences are and the nature of acceptable tradeoffs in the case of competition objectives.
3. To bring all options to the attention of decision makers.
4. To improve the quality and representativeness of information about technical coefficients, costs and benefits, especially those that are difficult to measure and those that imply compensation.
5. To improve the consciousness, involvement and commitment of the public to development.
6. To inform the public about available options and to improve the quality of public articulation.

Basic Principles of Public Participation

1. A high degree of integrity on the part of government must be seen as well as applied in the structuring and treatment of public inputs.
2. The public must know what it is participating in (for example, is the public being involved in a decision or in an education program or both?).
3. Firm positions, especially on the part of government, but also on the part of citizens should be avoided as long as possible to minimize ego damage and loss of face during a

process of convergence toward a broadly acceptable decision (effective contributions are inhibited and decision taking time is lengthened when important actors or groups must eventually capitulate).

4. The more dependent the success of a timber development proposal is on public support in achieving the objectives, the more thorough must be the airing of public issues and contributions.
5. Public participation is more objective and helpful, the more professional are the inputs.
6. Participation is more effective the less the hierarchy in the process, or the more direct the communications between government and public;
7. To infer a right direction from public participation requires expression by the various affinity groups within a community such as unemployed or underemployed people, youth, merchants, service industry operators and senior citizens, as well as nominal leaders and self-appointed spokespersons.

Procedural Parts of the Participation Process (regardless of the choice of options)

1. Assess the local social and political situation.
2. Select the right extent of participation for that situation.
3. Execute various participation techniques.
4. Monitor the situation to know how it is going.

Source: Phillips, *et al*, *The Role of Socioeconomic Evaluation in Timber Development Proposals in Alberta - Final Report*, for Alberta Forest Service (1981), 122-125.

Table B.1

Central Hypotheses and Laws of Bureaucracies

A. Central Hypotheses

1. Bureaucratic officials (and all other social agents) seek to attain their goals rationally.
2. Every official is significantly motivated by his own self-interest even when acting in a purely official capacity.
3. Every organizations social functions strongly influence its internal structure and vice versa.

B. The Laws

1. Law of Increasing Conservatism. All organizations tend to become more conservative as they become older, unless they experience periods of very rapid growth or internal turnover.
2. Law of Hierarchy. Coordination of large-scale activities without markets requires a hierarchical authority structure.
3. Law of Increasing Conserverism. In every bureau, there is an inherent pressure upon the vast majority of officials to become conservors in the long-run.
4. Law of Imperfect Control. No one can fully control the behaviour of a large organization.
5. Law of Diminishing Control. The larger an organization becomes the weaker is the control over its actions exercised by those at the top.
6. Law of Decreasing Coordination. The larger any organization becomes, the poorer is the coordination among its actions.
7. Power Shift Law. Unrestrained conflict shifts power upward.
8. Law of Control Duplication. Any attempt to control one large organization tends to generate another.
9. Law of Ever Expanding Control. The quantity and detail of reporting required by monitoring bureaus tends to rise steadily over time, regardless of the amount or nature of the activity being monitored.

10. Law of Counter Control. The greater the effort made by a sovereign or top-level official to control the behaviour of subordinate officials, the greater the efforts made by those subordinates to evade or counteract such control.
11. Law of Free Goods. Requests for free services always rise to meet the capacity of the producing agency.
12. Law of Non-Money Pricing. Organizations that cannot charge money for their services must develop nonmonetary costs to impose on their clients as a means of rationing their outputs.
13. Law of Progress Through Imperialism. The desire to aggrandize breeds innovation.
14. Law of Self-Serving Loyalty. All officials exhibit relatively strong loyalty to the organization controlling their job security and promotion.
15. Law of Interorganizational Conflict. Every large organiztion is in partial conflict with every other social agent it deals with.
16. Law of Countervailing Goal Pressures. The need for variety and innovation creates a strain toward greater goal diversity in every organization, but the need for control and coordination creates a strain toward greater goal consensus.

Source: Downs, A., *Inside Bureaucracy*, (Boston: Little, Brown and Company, 1967), 262-263.

Note: many of the Laws can be applied to private organizations as well.

Table B.2

Resource Agencies in British Columbia

1. Ministry of Forests
   a. Division:
      1) Information Services
      2) Strategic Studies
      3) Administration
      4) Systems Services
      5) Training Services
      6) Engineering
      7) Range Management
      8) Timber Management
      9) Inventory
      10) Valuation
      11) Planning
      12) Protection
      13) Research

2. Ministry of Lands, Parks and Housing
      1) Survey and Land Records Branch
      2) Parks and Outdoor Recreation Division

3. Ministry of Environment
   a. Branch:
      1) Fish and Wildlife Branch
      2) Marine Resource Branch

3) Water Rights Branch

4) Water Investigations Branch

5) Pollution Control Branch

6) Pesticide Control Branch

7) Surveys and Mapping Branch

4. Environment and Land Use Committee Secretariat
5. Agricultural Land Commission
6. Ministry of Agriculture
7. Ministry of Energy, Mines and Petroleum Resources
8. Ministry of Municipal Affairs
9. British Columbia Power and Hydro Power Authority
10. Fisheries and Marine Service
11. Ministry of Transport, Communications and Highways
12. British Columbia Development Corporation

Source: Various pages from the Ministry of Forests Forest and Range Resources Analysis Technical Report, (1980).

Table B.3

Federal Resource Agencies in British Columbia

1. Department of Fisheries and Oceans
2. Department of Regional Economic Expansion
3. Environment Canada
   a. Canadian Forestry Service
   b. Inland Waters Directorate
4. Energy, Mines, Resources Conservation and Renewable Energy

Source: Various pages from the Ministry of Forests Forest and Range Resources Analysis Technical Report, (1980).

Assumptions Used to Calculate the Nelson Watershed Operable Volume (1969-1989)

1. Mature operable volume at 1969
   a. based on T.S.A minimum harvesting ages.
   b. does not include ingrowth.
   c. not reduced by constraint other than by E.P.A. (environmental protection area) and E.P.F. (environmental protection forest).
2. Mature operable volume at 1979
   a. includes ingrowth to 1979.
   b. age class volumes advanced 1 class, with 50% volume attributed.
   c. no increase was made for ingrowth by increment.
3. Mature operable volume at 1989
   a. includes ingrowth to 1989.
   b. volume increased to recognize volumes avaiable by harvesting twilight (near mature or mature lodgepole pine) types.
   c. increase mature operable volume by the amount in 2. in some species and sub-drainages.
   d. in some cases twilight type volumes were added in without increase in meters cubed per hectare increment.
   e. some areas were assumed to have been selectively cut which altered the volume added in.

Assumptions Used in Calculating Net Present Value and Net Income Effect

1. Net Present Value

   a. Volume Harvested

      1) The volume harvested in each sub-drainage in one sweep will be 20 percent of the existing mature and overmature operable volume at the time of harvest.

      2) One half of the volume to be harvested (10 percent of the existing total mature and overmature operable volume) will be cut in one year, the exception being the Turnstall/8-Mile sub-drainage.

      3) From 1982 to the end of 1985 the volumes in sub-drainages were considered to be the sum of volumes in Tables 2.9 and 2.10. After 1985 volumes in sub-drainages were the sum of volumes in Tables 2.9, 2.10 and 2.11.

      4) Of the 20 percent of existing volume to be harvested in a sub-drainage, 90 percent will be sawlog size and 10 percent will be pulplog size.

      5) Right-of-way tree volumes were not included unless the road ran through a stand that would be harvested. Then the right-of-way volumes were part of the 20 percent of the total existing mature and overmature operable volume harvested.

   b. Revenues

      1) Prices used to calculate gross revenues for sawlogs from 1982 to 1990 were calculated using a model developed by Dr. M.R. Carroll for the Canadian Forestry Service (unpublished report, 1982) using Statistics Canada price indices extrapolated over the 1980-1990 period using five year price cycles.

      2) Prices for the 1991 to 1995 period were developed using a similar cycling method.

      3) Prices for the SPF (spruce-pine-fir) group were used because of the large volumes of the group that would be harvested in the Nelson Watershed.

      4) Prices used to calculate the gross revenues for air-dried bleached kraft pulp were derived by reviewing past price trends and by eliciting expert estimates. An

increase in price of 12.0 percent per annum was used for the 1982-1995 period.

5) The exchange rate between Canada and the United States was assumed to remain constant over the harvesting period (1982-1995).

6) All wood harvested in a particular year would be processed into lumber and pulp and sold in the same year.

c. Operating and Milling Costs

1) No separation was made between different harvesting and reforestation methods used (e.g., clear-cut versus selective-cut).

2) All harvesting, reforestation, milling, transportation and administrative costs (excluding road construction and stumpage costs) were lumped together and were considered an average for all sites. Hauling distance was allowed to range from 20 to 50 kilometers with no increase in cost. Residual chips were shipped from Nelson to the pulpmill at Castlegar at no cost.

3) All costs would increase 12.0 percent per annum over the harvesting period.

d. Lumber Recovered

1) The amount of lumber recovered was determined using the existing British Columbia interior lumber recovery equation (see Chapter IV). Average sawlog d.b.h. (diameter-at-breast-height) was assumed to be between 45.0 and 49.9 centimeters.

2) The lumber recovery factor was made species variable. With S (spruce), B (balsam fir), F (Douglas fir), L (larch) and Pl (lodgepole pine) species the L.R.F. used was 246 board feet/meter^3. With H (hemlock) and Pw (Western White pine) the L.R.F. used was 228 board feet/meter^3 and with C (cedar) the L.R.F. was 238 board feet/meter^3.

3) Decay volume would average 2.5 percent per log harvested.

e. Pulp Recovered

1) The volume of green wood necessary to produce one tonne of bleached kraft pulp

(airdry = 10% moisture content and 6% loss for bleaching) was varied according to species as follows:

a) Pw = 5.99 m^3/tonne

b) L = 5.32 m^3/tonne

c) B = 6.62 m^3/tonne

d) S = 5.91 m^3/tonne

e) Pl = 5.32 m^3/tonne

f) F = 4.84 m^3/tonne

g) C = 7.28 m^3/tonne, and

h) H = 5.15 m^3/tonne.

2) Residual wood chips from the sawmilling process were converted to airdry tonnes by using species variable constants for airdry tonnes of pulp (kraft) per thousand board feet (mfbm) of lumber produced, they were:

a) Pw = 0.239 tonnes/mfbm

b) L = 0.266 tonnes/mfbm

c) B = 0.239 tonnes/mfbm

d) S = 0.238 tonnes/mfbm

e) Pl = 0.266 tonnes/mfbm

f) F = 0.291 tonnes/mfbm

g) C = 0.194 tonnes/mfbm, and

h) H = 0.273 tonnes/mfbm.

f. Road Costs

1) One-half of the total road length proposed for each sub-drainage would be built in one year (except the Turnstall/8-Mile sub-drainage).

2) One-half of the number of bridges and culverts necessary for harvesting in a sub-drainage would be constructed in the first year of harvest (except Turnstall/8-Mile).

3) Road, bridge and culvert construction costs increase by 12.0 percent per annum.

g. Stumpage Costs

1) Stumpage values were calculated using the existing interior appraisal formula (see Chapter V). A margin for profit and risk using 20 percent of the operating costs plus upset price was used.

2) Road, bridge and culvert costs would generally be subtracted from stumpage costs. Occasionally road costs were greater than the stumpage costs, the remainder was subtracted from gross revenues.

2. Net Income Effect

1) An average gross (1982) salary of 12.90 $/hour (Regional District of Central Kootenay Economic Profile) on an eight hour day (103.20 $/day, 516.00 $/week and 2 064 $/month) and 24 768 $/year was used for the forestry and linked sectors.

2) An average net (1982) salary was calculated using a 20 percent annual income tax rate. This rate was assumed not to change over the harvest period (1982-1990) or (1987-1995).

3) An average family or individual would spend 50 percent of its disposable income on basic goods in the local community, i.e., the Regional District of Central Kootenay. The Nelson sawmill (B.C. Timber) output capacity as of 1982 was 55 mmfbm per year and the Castlegar (B.C. Timber) pulpmill capacity in 1982 was 175 000 airdry tonnes of bleached kraft pulp per year.

4) Pulpmill and sawmill jobs would be lost at a rate directly proportional to the amount of wood withdrawn from harvest allocation in a particular sub-drainage. The main assumption being that the timber supply was sufficiently constrained that any reduction in the available supply of wood would force the mills to run below capacity which would result in layoffs.

5) An employment multiplier of 1.5 was used to determine the number of jobs lost in

sectors linked to the forestry sector. This coefficient was derived by dividing the total number of jobs indirectly stemming from forestry sector activity (4 926) by the total number of persons employed directly in the forestry sector (3 283).

6) Employment at the B.C. Timber sawmill at full capacity was approximately 166/day plus 33 in woods operations (20 percent of 166) and 650 in the Castlegar pulpmill. Total employment was determined to be 849/day.

7) Individuals employed in woods operations at the Castlegar pulpmill were not included because the wood would be harvested by the woods workers of the Nelson sawmill only.

Nelson Watershed Harvesting Assumptions

1. Full operable area of the Nelson Watershed is allocated for harvesting over a nine year period.
2. Twenty percent of the operable mature and overmature volume in each sub-drainage will be harvested plus veterens.
3. Harvesting will be carried out during the winter months on sites having excessive ground moisture and/or erosion hazards. Drier less sensitive sites will be harvested during the fall months, September through to the end of October. Sites having few soil stability and moisture problems will be harvested in the summer. Steeper slopes will also be harvested in winter.
4. Form of harvest:
   a. Spruce-balsam fir: diameter limit selection cut.
      1) (age classes 7, 8 and 9)
   b. Hemlock-cedar: cutblocks to run with contours, narrow and less than 16 hectares in size.
      1) (age classes 7, 8 and 9)

c. White and lodgepole pine: diameter limit selection cut or clear cut.

1) (age classes 5 and 6)

d. Douglas-fir and larch: diameter limit selection cut.

1) (age classes 5, 6 and 7)

e. Veterens in immature and spruce stands: selection cut

f. Logging equipment-emphasis on small size.

1) S-B: crawler tractor, 100 H.P. or less, blade eight feet or less.

2) C-H: crawler tractor, D6 or less, rubber tired skidder on side slopes up to 40 percent.

3) Pl-Pw: as in S-B.

4) F-L: as in C-H.

5) Vets: as in S-B. Note on sites a large distance from main landings a F.M.C. 200 C.A. may be used with swing trails. However, the size of landings must not become large.

5. Slash disposal: lop and scatter, no burning.

6. Roads are to be constructed in the late fall and winter months to minimize disturbances.

7. Bridges over large and intermediate sized creeks (determined by flow volume and rate) must be constructed. Main tributary channels must have adequate cross drains (determined by stream flow analysis).

8. Reforestation of all harvested sites (container or bare root stock) immediately after harvest in the late spring.

Appendix C

CONFIDENTIAL

PARTICIPANT SURVEY

(Note: Use blank page provided at the end of the survey, if extra space is needed)

1. Place of residence (City or Community)_____

2. Length of residence in West Kootenay area _____

3. In your residence, what is the source of your drinking water?
   (a) piped city water _____
   (b) well _____
   (c) spring _____
   (d) other (please specify) _____

4. Within these four age groupings, please check the grouping which would contain your age.
   (a) 18 to 34 years ____
   (b) 35 to 49 years ____
   (c) 50 to 64 years ____
   (d) 65 yrs. and over ____

5. Please indicate where you spent the majority of your first twenty years:
   _____ Rural Area (less than 1,000 population) not adjacent to a town or city.
   _____ Town (1,000 to 10,000 population) or rural area adjacent to a town.
   _____ City (over 10,000 population) or rural area adjacent to a city.

6. Occupation _____

7. Education (please circle highest year/grade completed)

High School	10	11	12	13					
Technical School	1	2	3	4					
University	1	2	3	4	5	6	7	8	9

8. Please list your main interests or hobbies, if any, for each category:
   Outdoor _____
   Indoor _____

9. Membership in any associations, institutes, federations, interest groups and clubs (give name and length of membership in years):
   Association i) Name _____ Length _____
   ii) Name _____ Length _____
   Institute i) Name _____ Length _____
   ii) Name _____ Length _____

9. (Continued)

Federation i) Name _____ Length _____

ii) Name _____ Length _____

Interest Grp. or Club i) Name _____ Length _____

ii) Name _____ Length _____

10. Do you feel that any of the groups, etc. of which you are a member, have concerns with respect to the development of the Nelson Watershed? If yes, please list below their names, major concerns (describe briefly) and their main goals:

i) Name _____

Concerns _____

_____

Goals _____

_____

ii) Name _____

Concerns _____

_____

Goals _____

iii) Name _____

Concerns _____

_____

Goals _____

_____

iv) Name _____

Concerns _____

_____

Goals _____

_____

11. In your opinion, how do you think the majority of people living in the Nelson Watershed area (rural and urban) would like to see the Watershed used?

_____

_____

_____

_____

12. What land use alternative would you like to see implemented in the Nelson Watershed?

13. What form of land use do you feel would be the most socially beneficial for the inhabitants of the Nelson Watershed Area?

CONFIDENTIAL

GROUP, AGENCY OR FIRM SURVEY

(Note: Use blank page provided at the end of the survey, if extra space is needed)

1. What is the name of the interest group, public agency or industrial firm that you represent?

   Interest Group _____

   Public Agency _____

   Industrial Firm _____

   *If you represent an interest group, please complete Question #2 below; if not, continue to Question #3.

2. (a) How many regular members does your group have? _____

   (b) Approximately how long (in years) has the group formally been in existence? _____

   (c) Does your group meet on a regular basis?

   Yes ____ How Often? _____

   No ____ Under what circumstances do they meet? _____

   _____

   (d) Are the meetings generally run formally (i.e., using a parliamentary format) or informally?

   Formally ____

   Informally ____ In general, how are they run? _____

   _____

   (e) Were there any special circumstances or reasons why your group formed?

   _____

   _____

   _____

   (f) In general, what are the chief goals or aims of your group?

   _____

   _____

   _____

   _____

(g) Overall, does the group feel its input is:

	Frequently	Infrequently	Never
i) Listened to by resource agencies when they form policies?	___	___	___
ii) Listened to by resource agencies when they make operational decisions?	___	___	___
iii) Effective in changing resource agency policies?	___	___	___
iv) Effective in changing resource agency operational decisions?	___	___	___

(h) Can you give any examples where your group's input has been incorporated into resource agency decisions and policies, or has significantly affected them?

_____

_____

_____

(i) What resource agencies does your group generally deal with?

(a) Ministry of Forests ___

(b) Ministry of Lands, Parks and Housing
- Lands Branch ___
- Parks and Outdoor Recreation Division ___
- Housing ___

(c) Ministry of Environment
- Fish and Wildlife Branch ___
- Marine Resource Branch ___
- Water Rights Branch ___
- Water Investigations Branch ___
- Pollution Control Branch ___
- Pesticide Control Branch ___
- Surveys and Mapping Branch ___
- Resource Analysis Branch ___

(d) Environment and Land Use Committee Secretariat ___

(e) Agricultural Land Commission ___

(f) Ministry of Agriculture ___

(g) Ministry of Energy, Mines and Petroleum ___

(h) Ministry of Municipal Affairs ___

(i) British Columbia Hydro and Power Authority ___

(j) Fisheries and Marine Service ___

(k) Department of Regional Economic Expansion ___

(l) Other (Please specify) _____

(j) How would your group, as a whole, like to see the Nelson Watershed used now and in the future?

_____

_____

_____

_____

3. (a) What position do you hold with a public agency or industrial firm?

_____

(b) Briefly describe the nature of your job responsibilities.

_____

_____

(c) Does your agency or firm communicate or interact with interest groups?

Yes _____ No _____

*If the answer above was YES, please complete the remainder of Question #3. If the answer was NO, please proceed to Question #4.

(d) How often, on average, does the communication or interaction occur?

Daily _____ Monthly _____

Weekly _____ Yearly _____

(e) What form do the majority of these interactions take?

Telephone Conversations _____ Public Hearings _____

Informal Meetings _____ Formal Meetings _____

Personal Correspondence _____

(f) Overall, do you feel that your resource agency:

	Frequently	Infrequently	Never
i) Listens to interest groups when it formulates policies?	___	___	___
ii) Listens to interest groups when it makes operational decisions?	___	___	___
iii) Responds to interest group input by trying to incorporate it into policies?	___	___	___
iv) Responds to interest group input by trying to incorporate it into operational decisions?	___	___	___

3. (Continued)

(g) Can you give any examples where your agency has incorporated interest group aims or input into its decisions and policies, or has been significantly affected by them?

_____

_____

_____

(h) Do the policies and directives of your resource agency directly allow for the incorporation of interest group aims into policies and decisions that are developed? Explain.

_____

_____

_____

(i) Do you feel that the majority of interest groups that you deal with are satisfied by your responses to them? Explain.

_____

_____

4. (a) At present, does the agency or firm for which you work have an interest in some aspect of the Nelson Watershed (i.e., resources, planning or management)?

Yes _____ No _____

If the above answer is YES, briefly list the most important interests that it has:

i) _____

ii) _____

iii) _____

(b) As a representative of your agency or firm, how do you feel the Nelson Watershed should be used?

_____

_____

_____

_____